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(54) **TURBINE BUCKET PROFILE YIELDING IMPROVED THROAT**

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F01D 5/14 (2006.01)

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CPC F01D 5/02; F01D 5/141; F05D 2250/74; Y02E 20/16; Y02T 50/671; Y02T 50/673
See application file for complete search history.

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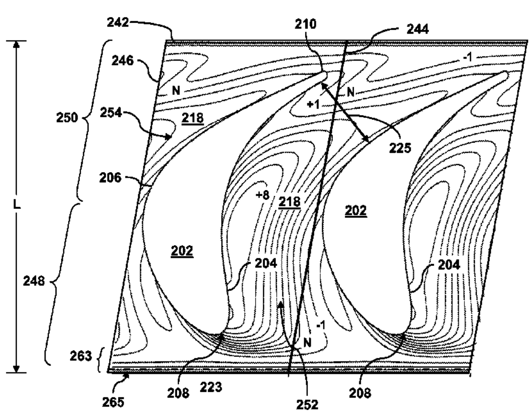
(57) **ABSTRACT**

Turbine frequency tuning, fluid dynamic efficiency, and performance can be improved using a particular airfoil profile, which can be used to determine a throat between adjacent airfoils. By shaping the throat according to the particular profile, the total pressure at an endwall can be energized, improving performance of the turbine.

20 Claims, 9 Drawing Sheets



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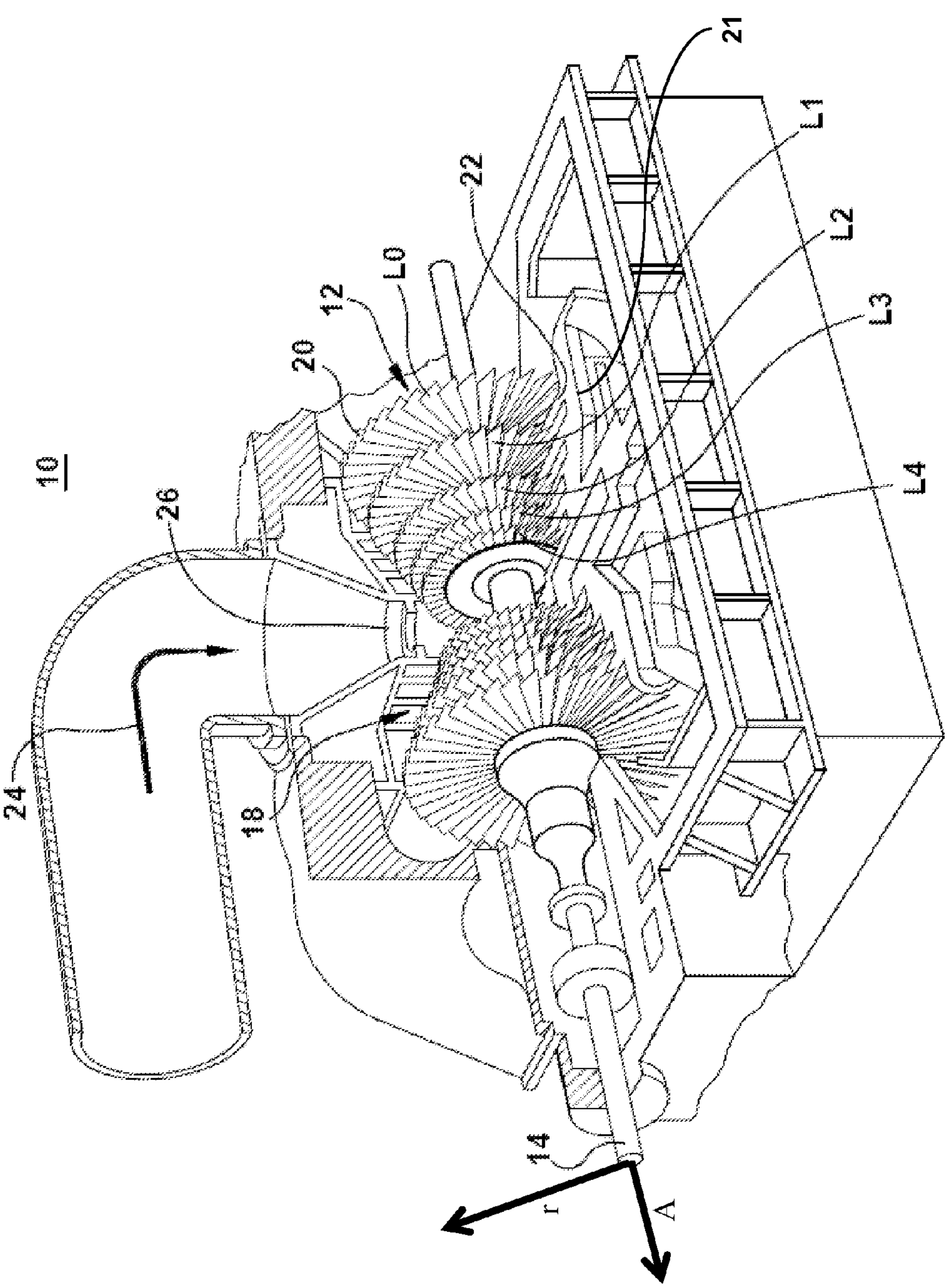


FIG. 1

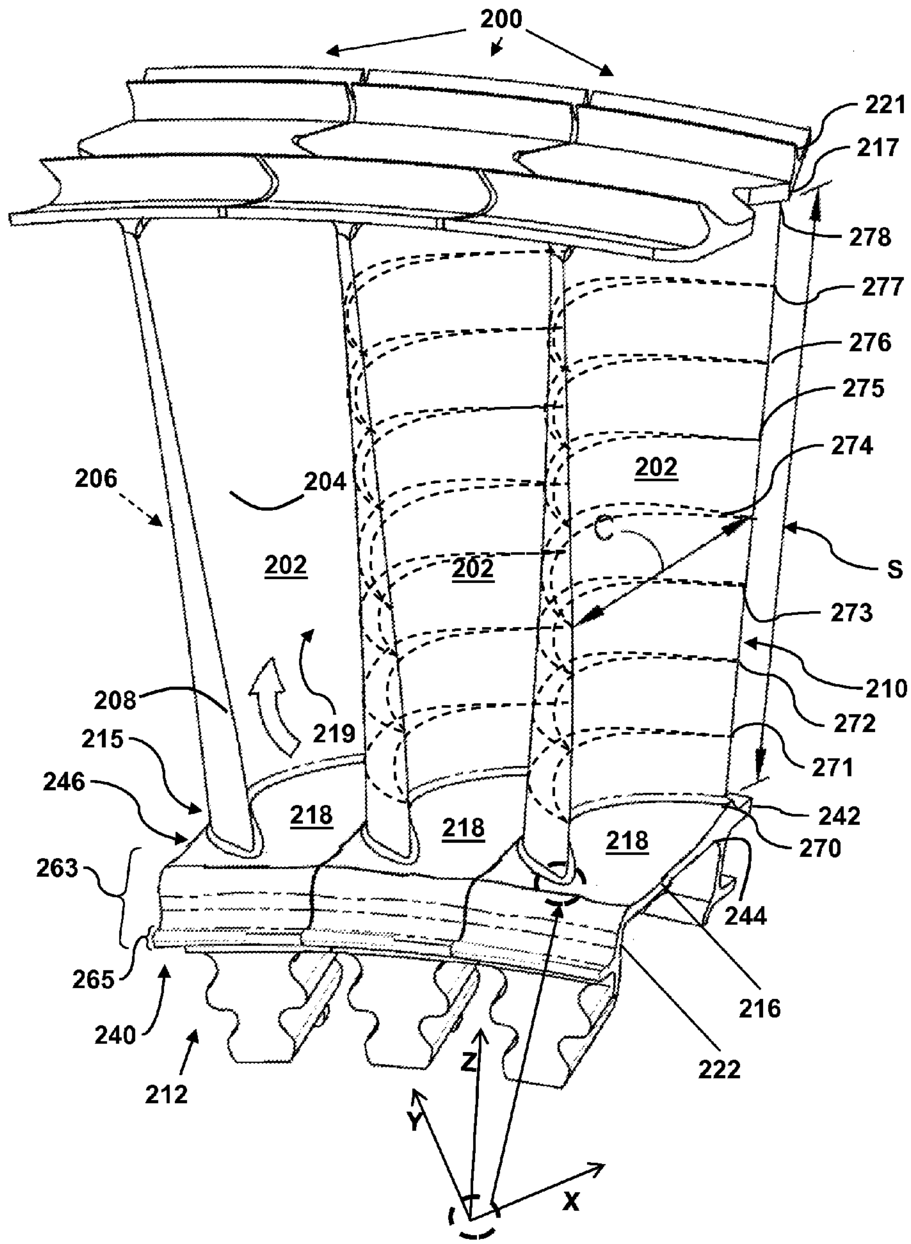

200
221
217
278
277
276
275
274
206
204
202
202
202
S
273
210
208
219
272
215
271
246
218
218
218
242
270
263
244
265
216
240
222
212
Z
Y
X
C

FIG. 2

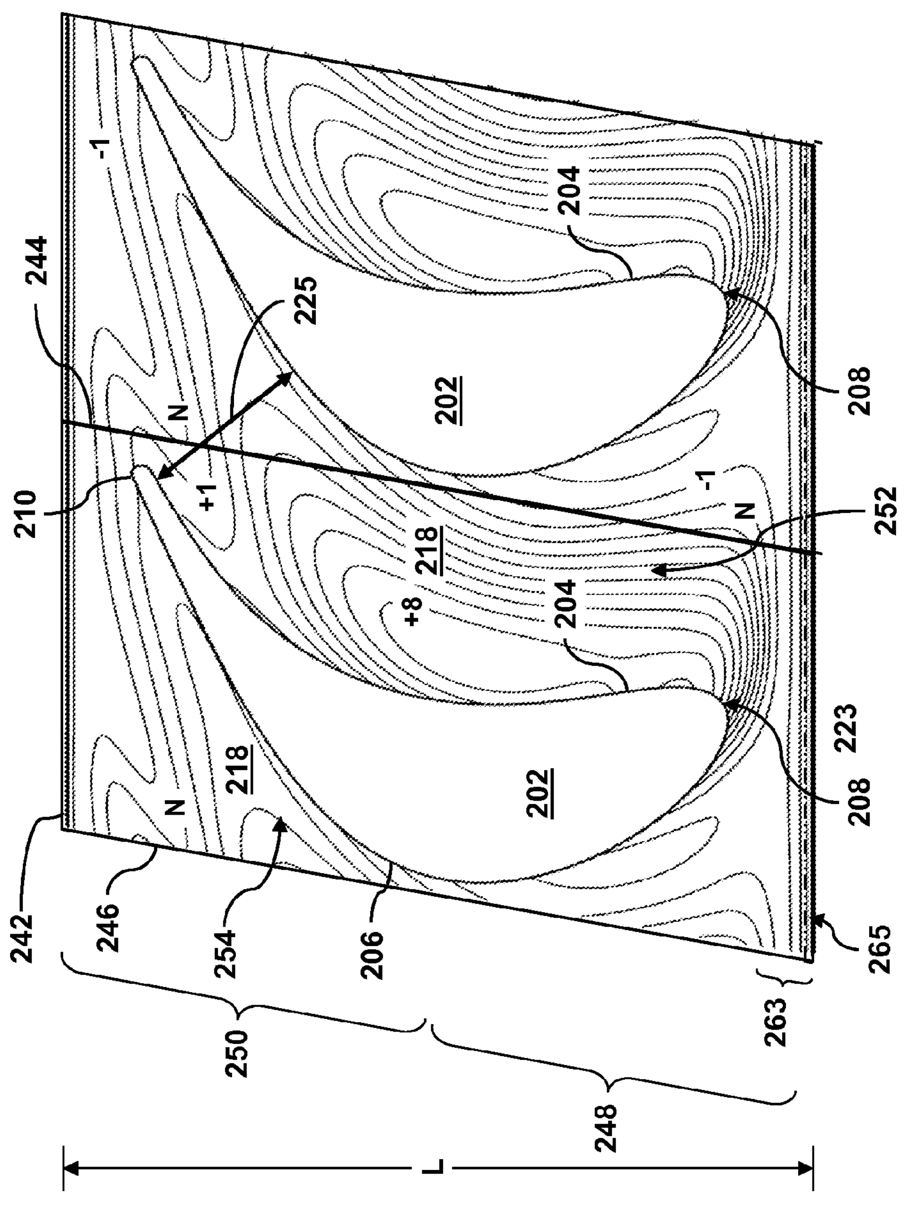
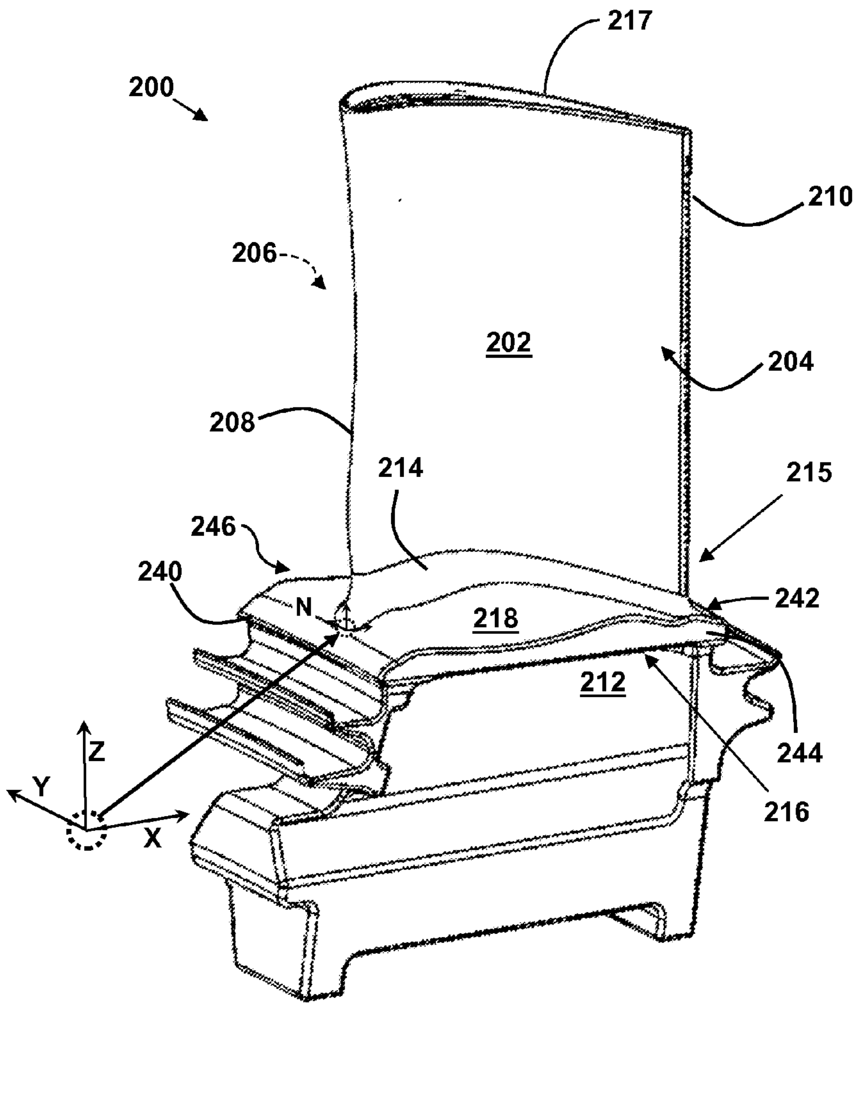

244
225
210
202
204
208
218
252
223
242
246
254
206
265
263
250
248
L
N
+1
-1
+8

FIG. 3



217
200
210
206
202
204
208
214
215
246
240
242
N
218
212
244
Z
Y
X
216

FIG. 4

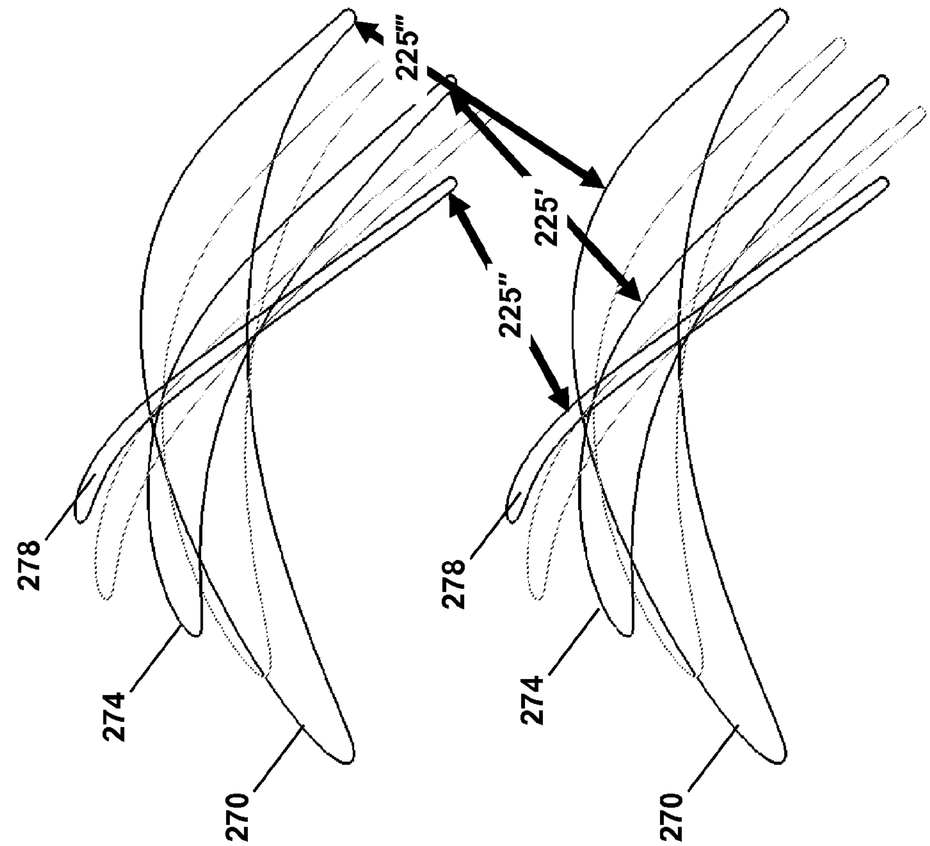


FIG. 5

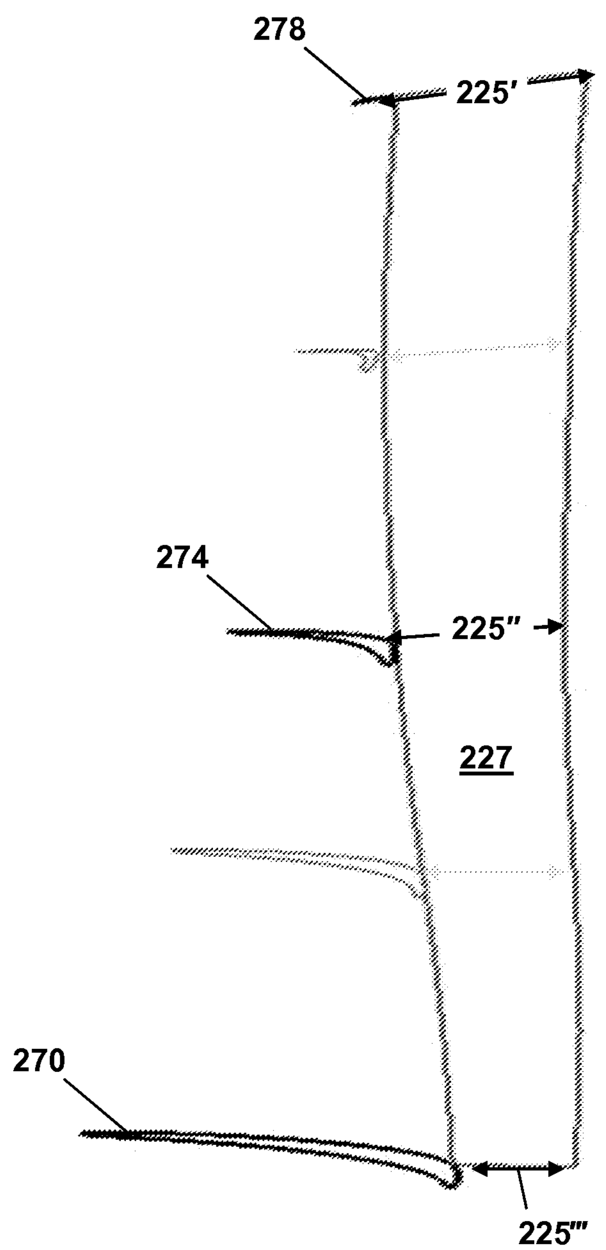


FIG. 6

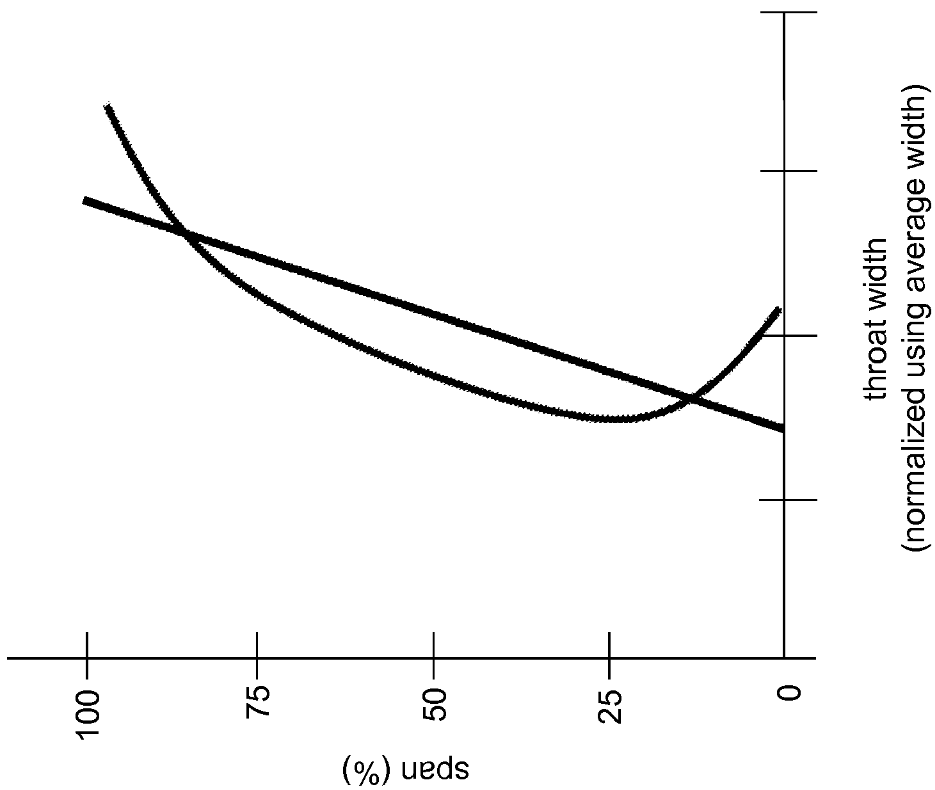

span (%)
100
75
50
25
0
throat width
(normalized using average width)

FIG. 7

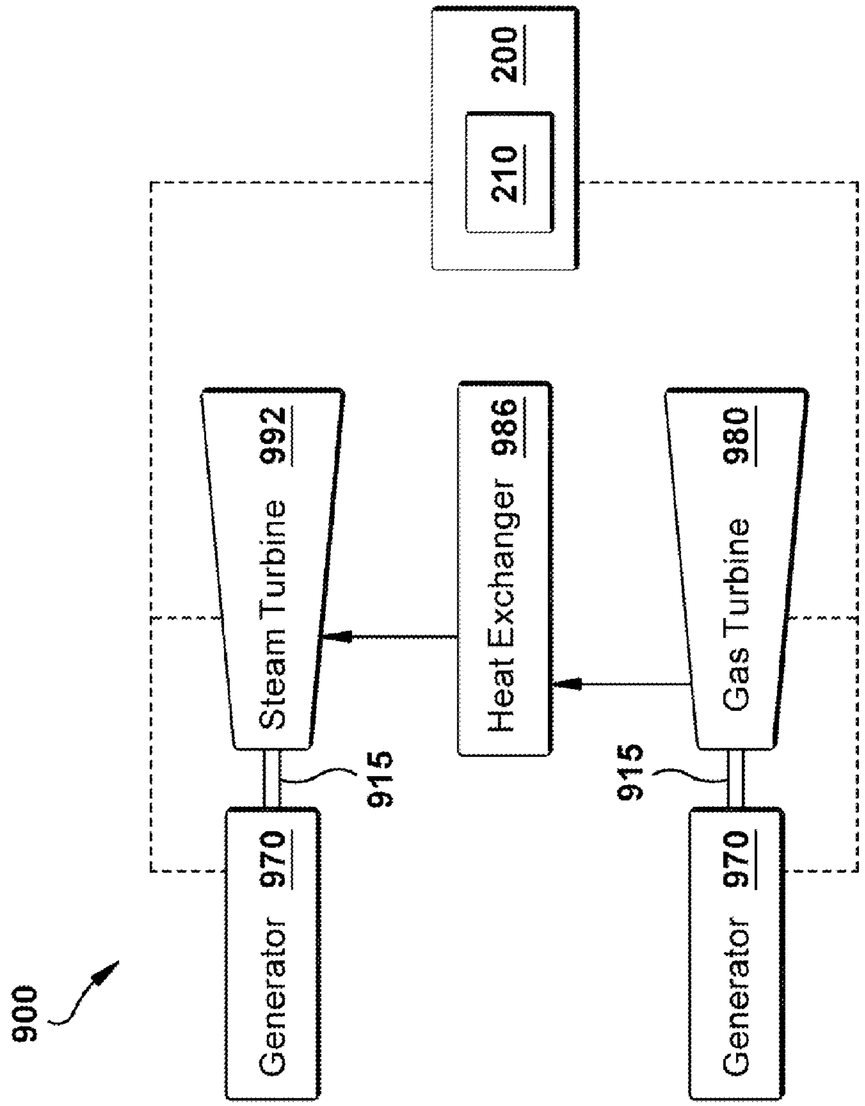

200
210
Steam Turbine 992
Heat Exchanger 986
Gas Turbine 980
915
915
Generator 970
Generator 970
900

FIG. 8

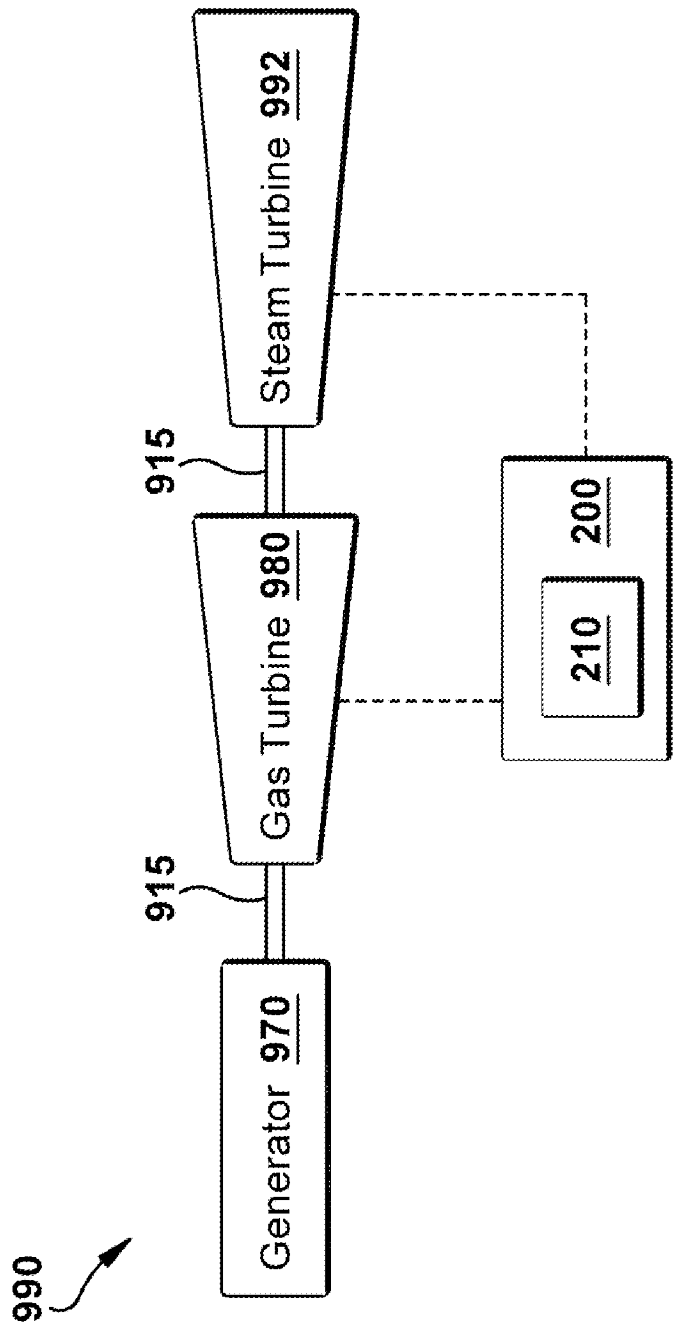

Steam Turbine 992
915
Gas Turbine 980
915
Generator 970
990
200
210

FIG. 9

TURBINE BUCKET PROFILE YIELDING IMPROVED THROAT

BACKGROUND OF THE INVENTION

The subject matter disclosed herein relates to turbine components for aircraft and power generation applications, and, more specifically, to turbine buckets including a base, an airfoil portion having a profile configured to yield a throat between adjacent airfoils that can increase total pressure at sidewalls of the airfoils.

Some aircraft and/or power plant systems, for example certain jet aircraft, nuclear, simple cycle and combined cycle power plant systems, employ turbines in their design and operation. Some of these turbines include one or more stages of buckets which during operation are exposed to fluid flows. Each bucket can include a base supporting a respective airfoil (e.g., turbine blade, blade, etc.) configured to aerodynamically interact with and extract work from fluid flow (e.g., creating thrust, driving machinery, converting thermal energy to mechanical energy, etc.) as part of, for example, power generation. As a result of this interaction and conversion, the aerodynamic characteristics and losses of these airfoils have an impact on system and turbine operation, performance, thrust, efficiency, and power at each stage.

BRIEF DESCRIPTION OF THE INVENTION

A first embodiment of the invention disclosed herein can include a turbomachine including a row of substantially identical buckets circumferentially mounted on a rotor, each bucket including a respective airfoil with opposed pressure and suction sidewalls extending chordwise between opposed leading and trailing edges and spanwise between a root and a tip. A flow passage between each pair of airfoils can include a pressure sidewall of a first airfoil and a suction sidewall of a second airfoil substantially facing the pressure sidewall of the first airfoil. A throat can include an area defined at least in part by a minimum gap between the pressure sidewall of the first airfoil and the suction sidewall of the second airfoil for each corresponding chord along spans of the first and second airfoils, an absolute value of a rate of change of the width of the throat versus span increasing with decreasing distance to at least one of the tips or the roots of the first and second airfoils within a first distance from the at least one of the tips or the roots.

In addition, a second embodiment of the invention disclosed herein can be implemented as a turbine with a plurality of airfoils mounted on a rotor of a turbine about an axis of rotation of the turbine in a substantially circumferential, spaced-apart fashion, each airfoil including respective opposed pressure and suction sidewalls extending chordwise between respective opposed leading and trailing edges and spanwise between opposed inner and outer endwalls, a respective root of each airfoil connected to one of the inner and outer endwalls, and at least one of the suction sidewall or the pressure sidewall including a nominal profile substantially in accordance with non-dimensional Cartesian coordinate values of X, Y, and Z set forth in TABLE I, wherein the coordinate values are non-dimensionalized and convertible to distances by multiplying the coordinate values by a desired span in units of distance, and wherein X and Y values connected by smooth continuing arcs define profile sections of the at least one of the suction sidewall or the pressure sidewall at each distance Z along the airfoil, the profile sections at the Z distances being joined smoothly with one another to form the profile of the at least one of the suction sidewall or the pressure sidewall. A total throat can include a component throat between adjacent airfoils of the plurality of airfoils, each component throat including a minimum gap between a pressure sidewall of a first airfoil and a suction sidewall of a second airfoil adjacent to the first airfoil for all corresponding points along spans of the first and second airfoils, a width of the component throat increasing with decreasing distance to at least one of the tips of the roots within a first distance away from the at least one of the tips or the roots.

Further, a third embodiment of the invention disclosed herein can take the form of a turbine system having a compressor section, a combustion section, and a turbine section, wherein a stage of the turbine section includes a plurality of substantially identical airfoils substantially circumferentially spaced apart about an axis of rotation of the turbine section, each airfoil including opposed pressure and suction sidewalls extending chordwise between opposed leading and trailing edges and spanwise between opposed respective roots and tips. At least one of the suction sidewall or the pressure sidewall of each airfoil can include a nominal profile substantially in accordance with non-dimensional Cartesian coordinate values of X, Y, and Z set forth in TABLE I, wherein the coordinate values are non-dimensionalized and convertible to distances by multiplying the coordinate values by a desired span in units of distance, and wherein X and Y values connected by smooth continuing arcs define profile sections of the at least one of the suction sidewall or the pressure sidewall at each distance Z along the airfoil, the profile sections at the Z distances being joined smoothly with one another to form the profile of the at least one of the suction sidewall or the pressure sidewall. A total throat can include a component throat between each pair of adjacent airfoils, each component throat including an area defined at least in part by a minimum gap between a pressure sidewall of a first airfoil and a suction sidewall of an adjacent second airfoil for all points along spans of the first and second airfoils, a width of the component throat increasing with decreasing distance to the roots of the first and second airfoils within a first distance from the roots and within a second distance from the tips.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features of this invention will be more readily understood from the following detailed description of the various aspects of the invention taken in conjunction with the accompanying drawings that depict various embodiments of the invention, in which:

FIG. **1** shows a three-dimensional partial cut-away perspective view of a portion of a turbine according to an embodiment of the invention;

FIG. **2** shows a portion of a set of buckets according to embodiments of the invention disclosed herein.

FIG. **3** shows a cross sectional view of a pair of the buckets according to embodiments of the invention disclosed herein and shown in FIG. **2** taken along corresponding sections **271**.

FIG. **4** shows a perspective view of a turbine bucket according to embodiments of the invention disclosed herein.

FIG. **5** shows a representation of a throat between a pair of adjacent buckets employing an airfoil profile according to embodiments of the invention disclosed herein viewed from tips of the buckets toward roots of the buckets.

FIG. **6** shows a graphical representation of an imaginary surface of a throat according to embodiments of the invention disclosed herein.

FIG. **7** shows a schematic graph of span versus throat width of a pair of buckets employing the airfoil profile according to embodiments of the invention disclosed herein.

FIG. 8 shows a schematic block diagram illustrating portions of a combined cycle power plant system in which embodiments of the invention disclosed herein can be used.

FIG. 9 shows a schematic block diagram illustrating portions of a single-shaft combined cycle power plant system in which embodiments of the invention disclosed herein can be used.

It is noted that the drawings of the invention are not necessarily to scale. The drawings are intended to depict only typical aspects of the invention, and therefore should not be considered as limiting the scope of the invention. It is understood that elements similarly numbered between the FIGURES may be substantially similar as described with reference to one another. Further, in embodiments shown and described with reference to FIGS. **1-9**, like numbering may represent like elements. Redundant explanation of these elements has been omitted for clarity. Finally, it is understood that the components of FIGS. **1-9** and their accompanying descriptions may be applied to any embodiment described herein.

DETAILED DESCRIPTION OF THE INVENTION

Aspects of the invention provide for a turbine bucket including improved features, such as an airfoil including a particular profile and/or a fillet on an end of the airfoil that can yield a performance-enhancing throat of a turbine stage. In addition, thermal and mechanical operating requirements for a given stage can be met, component lifetime can be improved, cost can be lowered, and/or any other suitable system requirement and/or design goal can be improved.

In addition, aspects of the invention include a turbine bucket including a base supporting an airfoil at a first end of the airfoil. A top portion of the base at the first end of the airfoil can be construed as a platform or as an endwall. The airfoil can have a profile that can enhance fluid flow over the airfoil and/or over the endwall. The profile of the airfoil can be defined using multiple sets of two-dimensional coordinates, each set being provided for a respective section of the respective profile along the span of the airfoil. The profile can be used to determine and/or design a throat of a stage including the bucket and/or profile to enhance fluid flow from the stage to a next stage or other portion of a turbine in which the bucket is employed.

As used herein, the terms “axial” and/or “axially” refer to the relative position/direction of objects along axis A, which is substantially parallel to the axis of rotation of the turbomachine (in particular, the rotor section). As further used herein, the terms “radial” and/or “radially” refer to the relative position/direction of objects along any radius r extending substantially perpendicular to a rotational or longitudinal axis A, also called an axis of rotation. Additionally, the terms “circumferential” and/or “circumferentially” refer to the relative position/direction of objects along a circumference which surrounds axis A but does not intersect axis A at any location.

Referring to the drawings, FIG. **1** shows a perspective partial cut-away illustration of a turbine **10**, such as a gas or steam turbine. Turbine **10** can include a rotor **12** that with a rotating shaft **14** and a plurality of axially spaced rotor wheels **18**. A plurality of dynamic blades or buckets **20** can be mechanically coupled to each rotor wheel **18**, and can be arranged in a row that can extend circumferentially around a respective rotor wheel **18**. So arranged, when a rotor wheel **18** rotates, its respective dynamic blades or buckets **20** can revolve about an axis of rotation of the respective rotor wheel. A nozzle **21** can support a plurality of stationary blades or nozzles **22** circumferentially around shaft **14** between adjacent rotor wheels **18** and/or rows of dynamic buckets **20**. Blades or nozzles **22** can cooperate with dynamic blades or buckets **20** to form a stage of turbine **10** and to define a portion of a flow path through turbine **10**. As shown, nozzle **21** can at least partially surround rotor **12** (shown in this cut-away view) and in embodiments can completely surround rotor **12**.

While turbine **10** is shown in FIG. **1** as a dual-flow turbine **10** with an axially centered inlet mouth feeding two sets of turbine stages, various teachings disclosed herein can be applied to any suitable turbine, such as an axial turbine with a single primary direction of flow. For example, various teachings herein can be applied to an axial inlet gas turbine in which a combustion gas passes through an inlet at a first axial end, any stages of the turbine, and an outlet at a second axial end of the turbine, which enables the gas to perform mechanical work on the turbine.

In operation of the example turbine **10** shown in FIG. **1**, gas **24** can enter an inlet **26** of turbine **10** and can flow and/or be directed through stationary blades or nozzles **22**. Stationary blades or nozzles **22** can direct gas **24** against dynamic blades or buckets **20** so that gas **24** can pass around and/or over dynamic blades or buckets **20**. As a result of aerodynamic interaction between dynamic blades or buckets **20** and gas **24**, dynamic blades or buckets **20** can impart rotation to rotor wheel **18**. In embodiments of the invention disclosed herein, turbine **10** can include multiple stages, which can each include a respective row of stationary blades or nozzles **22** in nozzle **21** and a respective row of dynamic blades or buckets **20** on a respective rotor wheel **18**. It should be understood that, while there may be a plurality of rotor wheels **18**, they can all be affixed to shaft **14** so as to rotate in unison, all dynamic blades or buckets **20** thus imparting rotation on shaft **14** in concert.

In the example shown in FIG. **1**, turbine **10** can include five stages identified as a first stage L4, a second stage L3, a third stage L2, a fourth stage L1, and a fifth stage L0, which is also the last stage. Each stage has a respective radius, with first stage L4 having the smallest radius of the five stages and each subsequent stage having a larger radius, with fifth stage L0 having a largest radius of the five stages. While five stages are shown in FIG. **1**, this simply a non-limiting example, and the teachings herein can be applied to turbines having more or fewer stages, including a turbine with a single stage. In addition, while the example shown in FIG. **1** is stationary, the teachings herein can be applied to any suitable turbine, including turbines used in aircraft engines, and may also be applied to compressors.

Each set of blades **20**, **22** has a number of factors that can affect performance of turbine **10**. For example, FIGS. **2** and **3** illustrate part of a set of circumferentially spaced-apart blades **200**, which will be described as dynamic blades or buckets **20** of a rotor wheel **18**, though aspects of the description can apply to sets of stationary blades or nozzles **22** depending on a particular implementation. Additional reference can be made to FIG. **4**, which shows a single bucket **200** of embodiments in perspective. It is understood that bucket **200** can be configured to couple (mechanically couple via fasteners, welds, slot/grooves, contact, etc.) with a plurality of similar and/or distinct buckets (e.g., buckets **200** or other buckets) to form a set of buckets in a stage of the turbine. In addition, bucket **200** can be attached to a rotor wheel to form a set of buckets, which rotor wheel can be mounted on a shaft with fasteners, slots and grooves, welds, and/or other devices and/or techniques, and/or a hub of the rotor wheel can be integral with the shaft, and/or the hub can include a portion of the shaft that can be attached to other portions of the shaft via any suitable coupling.

Each bucket **200** can include an airfoil **202** with a pressure sidewall **204** and an opposed suction sidewall **206**, as well as a leading edge **208** and a trailing edge **210**. Each airfoil **202** can include a chord C between leading edge **208** and trailing edge **210** such that pressure and suction sidewalls **204**, **206** can be said to extend in chord or chordwise between leading edge **208** and trailing edge **210**. Airfoil **202** can be supported by a base **212**, and a fillet **214** can connect a first end **215** of airfoil **202** to a first endwall **216**, such as a radially inner endwall. Fillet **214** can include a weld or braze fillet, which can be formed via conventional MIG welding, TIG welding, brazing, etc., and can include a profile that can reduce fluid dynamic losses as a result of the presence of fillet **214**. In embodiments, base **212**, airfoil **202**, and fillet **214** can be formed as a single component, such as by casting and/or machining and/or 3D printing and/or any other suitable technique now known or later developed and/or discovered.

As is known in the art, base **212** can be designed to fit into a mating slot in a hub of a rotor wheel and/or a turbine rotor shaft, such as shaft **14** of FIG. **1**, and can engage and/or mate with adjacent base components of other buckets **200** if desired and/or suitable. In the case of a stationary blade or nozzle, base **212** can be designed to fit into a slot or other mounting feature in a nozzle of a turbine, such as nozzle **21** of FIG. **1**. In embodiments, because base **212** of dynamic blade or bucket **200** can have a relatively large mass, base **212** can be designed to be located radially inboard of airfoil **202** to reduce forces and stresses arising from revolution of bucket **200** about an axis of rotation during rotation of a respective rotor wheel and/or turbine shaft. Should appropriate materials and/or techniques be developed, base **212** and/or endwall **216** could instead be designed to be radially outward of airfoil **202**. In addition, in embodiments in the case of a stationary blade or nozzle, the corresponding base can be radially outward of the corresponding airfoil.

Airfoil **202** of dynamic blade or bucket **200** can extend radially from endwall **216** and can further have a span S between first end **215** and a second end **217** of airfoil **202**. Pressure and suction sidewalls **204**, **206** can be said to extend in span or spanwise between first and second ends **215**, **217** of airfoil **202**. That is, each bucket **200** can include an airfoil **202** having opposed pressure and suction sidewalls **204**, **206** extending in chord or chordwise between opposed leading and trailing edges **208**, **210** and extending in span or spanwise between opposed first and second ends **215**, **217** of airfoil **202**.

First endwall **216** can include a first contour **218** in embodiments that can be described relative to a nominal surface N of endwall **216**. Nominal surface N need not be an actual, physical surface, and instead can simply be a frame of reference. While any surface can be employed, in embodiments, referential or nominal surface N can be substantially cylindrical and located at any suitable known location. For example, nominal surface N can be located at a known radius of curvature, such as a radial distance from an axis of rotation of turbine **10** and/or where a surface of an uncontoured endwall ordinarily would be.

With particular reference to FIG. **3**, each passage **219** between each pair of airfoils **202** can be regarded as bounded by pressure sidewall **204** of a first airfoil **202**, suction sidewall **206** of a second airfoil **202**, and portions of first endwall **216** of each of the first and second buckets **200**. In embodiments, second end **217** of each airfoil **202** can end in proximity to a second endwall **221**, such as a radially outer endwall or shroud, and portions of adjacent second endwalls **221** can act as an additional boundary of passage **219**. In additional embodiments, particularly where airfoils **202** are part of stationary blades or nozzles, second end **217** of each airfoil **202** can be connected to endwall **221**.

Passage **219** can have at least one minimum gap **225** between airfoils **202** along corresponding chord lines C at a point along spans S of airfoils **202**. The combined minimum gaps **225** of all corresponding chord lines along spans S can define a throat of the pair of airfoils **202**, which is an area that can be visualized as a virtual surface. In embodiments, every throat between a respective pair of airfoils of a stage of buckets can be substantially identical, in part to avoid vibration that can be introduced by different flow rates in respective throats, which can damage a given stage of buckets or even an entire turbine. Thus, the sum of the throats of a stage of buckets **200** can be used to determine a total minimum area of the stage, which can be important to performance of and/or used to analyze and/or design a rotor wheel **18** and/or turbine **10**.

Where surfaces and edges of a pair of airfoils extend substantially along respective radii of a respective rotor wheel, the throat can be determined by measuring minimum gap at a few points, such as near the inner endwall, midspan, and near the outer endwall, averaging the values measured, and multiplying the average by the span of the airfoils. The resulting minimum area between the airfoils can be visualized as a virtual surface of substantially a quadrilateral shape and substantially planar. However, airfoil **202** can be a high-performance airfoil as seen, for example, in FIG. **4**, with a more complex shape and/or profile that can include curvature, twists, and other variations. As a result, a throat between two such more variable airfoils can be complex, as illustrated and/or visualized in FIGS. **5** and **6**. In FIG. **5**, two adjacent buckets **200** employing twisted or otherwise variable airfoils are shown, viewed from tips **217** toward roots **215**. As can be seen, the orientation and length of minimum gap **225** can vary, illustrated by minimum gap **225'** at tips **217**, minimum gap **225"** at midspan, and minimum gap **225'"** at roots **215**. Thus, minimum gap **225** can define a throat as a complex area or virtual surface **227** shown in FIG. **6**. Applying techniques used for simpler airfoils can therefore introduce error, such as up to 20%, which can be significant in design and analysis of a stage of buckets **200** and turbine **10** as a whole. In addition, while typical inner and/or outer endwalls can be substantially uniform, inner and outer endwalls **216**, **221** can include contours, which can further complicate determination of the throat. Such more complex profiles and/or contours can produce more efficient flow in passage **219**, as well provide additional space for cooling passages and/or support structures within parts of a bucket.

Determination of throat **227** between pairs of high-performance airfoils **202** can be aided using a set of coordinates describing and/or defining the three-dimensional profile of each airfoil. For example, a unique set or loci of points in space can be provided, such as those listed in TABLE I, below, and can meet stage requirements for manufacture and performance. The loci of points can be arrived at by iteration between aerodynamic, thermal, and mechanical loadings enabling operation in an efficient, safe, and smooth manner. The loci, as embodied by the invention, can define the bucket airfoil profile for airfoil **202** and can comprise a set of points relative to any suitable frame of reference and/or origin, such as the axis of rotation of turbine **10**, a coordinate system of turbine **10**, and/or an origin located at a desired and/or suitable point of the airfoil and/or base and/or any other suitable component.

For example, a Cartesian coordinate system of X, Y, and Z values can be used to define a profile of airfoil **202**, such as the values listed in TABLE I, below. With the origin at leading edge **208** in nominal surface N, the X and Y axes can be rotated such that the X axis extends along a chord of airfoil **202** at the nominal surface N, and such that the Y axis lies orthogonal to the X axis in the nominal surface N. The Z axis can then extend radially away from nominal surface N. Any other suitable orientation of the axes relative to airfoil **202** can be used so long as such orientation is taken into account in the resulting coordinate values. In embodiments, the coordinate system that defines the profile can be based on its own geometry and thus can be used to produce an airfoil with the described profile regardless of its location.

With reference to FIG. **2**, a plurality of points **270-278** along span S, including root **215** and tip **217**, can correspond to Z coordinate values of chord lines, and a cross section of airfoil **202** at each point can be described by a respective set of X and Y coordinates. For example, 100 points can be listed for each of pressure side **204** and suction side **206** for each cross section **270-278**, though it should be apparent that more or fewer points can be used for each cross section, and more or fewer cross sections can be used, as may be desired and/or appropriate. The X, Y, and Z coordinate values in TABLE I have been expressed in non-dimensionalized form representing normalized distances in values that can range from −1 to 1, but it should be apparent that any or all of the coordinate values could instead be expressed in distance units so long as the proportions are maintained. TABLE I includes the heading, "Non-Dimensionalized (X Y Z/Span)," and in embodiments a desired span can be used to convert a coordinate value of TABLE I to a respective coordinate value in units of distance, such as inches or meters. In other words, the non-dimensional values given in TABLE I can be multiplied by a desired span of airfoil **202**, such as, for example, a desired span of between about 3 inches and about 10 inches, such as between about 5 inches and about 8 inches, to obtain coordinate values in units of distance. By connecting the X and Y values with smooth continuing arcs, each profile cross section at each distance Z can be fixed, and the airfoil profiles of the various surface locations between the distances Z can be determined by smoothly connecting adjacent profile sections to one another, thus forming the airfoil profile.

The 2,200 points for the coordinate values shown in TABLE I are generated and shown to three decimal places for determining the profile of a nominal airfoil **202** at ambient, non-operating, or non-hot conditions, and do not take any coatings or fillets into account, though embodiments could account for other conditions, coatings, and/or fillets. To allow for typical manufacturing tolerances and/or coating thicknesses, ±values can be added to the values listed in TABLE I, particularly to the X and Y values therein. For example, a tolerance of about 10-20 percent of a thickness of the trailing edge in a direction normal to any surface location along the airfoil profile can define an airfoil profile envelope for a bucket airfoil design at cold or room temperature. In other words, a distance of about ±10% to about ±20% (±0.010 to ±0.020 non-dimensionally) of the thickness of the trailing edge in a direction normal to any surface location along the airfoil profile can define a range of variation between measured points on an actual airfoil surface and ideal positions of those points, particularly at a cold or room temperature, as embodied by the invention. The bucket airfoil design, as embodied by the invention, is robust to this range of variation without impairment of mechanical and aerodynamic functions. Likewise, the profile and/or design can be scaled up or down, such as geometrically, without impairment of operation, and such scaling can be facilitated by use of normalized coordinate values, i.e. multiplying the normalized values by a scaling factor, or a larger or smaller span in distance units than might have otherwise been used.

By employing coordinates defining a profile of airfoil **202**, a throat between adjacent airfoils **202** can be determined to at least ends of airfoils **202**. For example, FIG. **6** shows a virtual surface representing a particular throat **227** that can be found between adjacent airfoils **202** using the profile shown in TABLE I. As can be seen in FIG. **6**, the surface can be quite complex. In embodiments, a width of throat **227** along a span of airfoils **202** can vary as shown by example in FIG. **7**, which shows that throat width can be increased near root **215**. In addition, embodiments can increase the width of throat **227** near tip **217**. More particularly, in embodiments, a width of throat **227** can be increased within a first distance from first end **215** of the airfoil(s) **202** and/or a first endwall of flow passage **219**, such as endwall **216**, and can also be increased within a second distance from second end **217** of airfoil(s) **202** and/or a second endwall of flow passage **219**, such as endwall **221**, if present and/or used. For example, the first and/or second distance can be no more than about 25% of the span(s) of airfoil(s) **202**, and can in embodiments be no more than about 20% of the span(s).

The width of throat **227** can increase in embodiments by no more than about 15% of its value at the first and/or second distance mark, such as no more than about 10%, though in embodiments, other increases can be employed, and there need not be symmetry in the manner in which throat width may change as between first end **215** and second end **217**. For example, the throat width at first end **215** can be about 110% of the throat width at about 20% span and/or the throat width at second end **217** can be about 110% of the throat width at about 80% span (about 20% span away from second end **217**). Throat **227** in embodiments can flare open more toward first end **215** within about 20% span from first end **215** than throat **227** flares open toward second end **217** within about 20% span from second end **217**, and/or throat **227** can flare open more toward second end **217** within about 20% span from second end **217** than throat **227** flares open toward first end **215** within about 20% span from first end **215**. Also, throat **227** can flare open to at least about 10% of its width at about 20% span from at least one of first and second ends **215**, **217**. In addition to increasing the width of the throat, a rate of change of the width can be varied within the first distance from the first endwall and/or the second distance from the second endwall, if present and/or used. For example, an absolute value of the rate of change of the width with respect to span can increase within the first distance from the first endwall and/or within the second distance from the second endwall.

Returning to the example of a plot of span vs. throat width is shown in FIG. **7**, the widening of the throat at the root and/or tip of an airfoil can be seen as compared to a throat between airfoils employing a typical profile. In addition, the absolute value of a rate of change of the width of the throat vs. span of the airfoil(s), as represented by absolute value of the inverse of the slope of the curve shown in FIG. **7**, can also be seen to increase. By introducing such an increase of throat width, as well as such an increase in a rate of change of throat width, a total pressure at the respective pressure and suction sidewalls **204**, **206** of adjacent airfoils **202** can be increased. The increased total pressure can energize the flow over the airfoil sidewalls, which can reduce pressure separation of the flow, thus improving stage and/or diffuser and/or turbine efficiency.

Turning to FIG. **8**, a schematic view of portions of a multi-shaft combined cycle power plant **900** is shown. Combined cycle power plant **900** may include, for example, a gas turbine

980 operably connected to a generator 970. Generator 970 and gas turbine 980 may be mechanically coupled by a shaft 915, which may transfer energy between a drive shaft (not shown) of gas turbine 980 and generator 970. Also shown in FIG. 10 is a heat exchanger 986 operably connected to gas turbine 980 and a steam turbine 992. Heat exchanger 986 may be fluidly connected to both gas turbine 980 and a steam turbine 992 via conventional conduits (numbering omitted). Gas turbine 980 and/or steam turbine 992 may include one or more buckets 200 as shown and described with reference to FIGS. 2-4 and/or other embodiments described herein. Heat exchanger 986 may be a conventional heat recovery steam generator (HRSG), such as those used in conventional combined cycle power systems. As is known in the art of power generation, HRSG 986 may use hot exhaust from gas turbine 980, combined with a water supply, to create steam which is fed to steam turbine 992. Steam turbine 992 may optionally be coupled to a second generator system 970 (via a second shaft 915). It is understood that generators 970 and shafts 915 may be of any size or type known in the art and may differ depending upon their application or the system to which they are connected. Common numbering of the generators and shafts is for clarity and does not necessarily suggest these generators or shafts are identical. In another embodiment, shown in FIG. 9, a single shaft combined cycle power plant 990 may include a single generator 970 coupled to both gas turbine 980 and steam turbine 992 via a single shaft 915. Steam turbine 992 and/or gas turbine 980 may include one or more buckets 200 shown and described with reference to FIGS. 2-4 and/or other embodiments described herein.

The apparatus and devices of the present disclosure are not limited to any one particular engine, turbine, jet engine, generator, power generation system or other system, and may be used with other aircraft systems, power generation systems and/or systems (e.g., combined cycle, simple cycle, nuclear reactor, etc.). Additionally, the apparatus of the present invention may be used with other systems not described herein that may benefit from the increased reduced tip leakage and increased efficiency of the apparatus and devices described herein.

TABLE I

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
1	suction-side	0.000	0.000	0.000
2	suction-side	0.000	0.000	0.000
3	suction-side	0.000	0.006	0.000
4	suction-side	0.002	0.009	0.000
5	suction-side	0.004	0.012	0.000
6	suction-side	0.006	0.014	0.000
7	suction-side	0.008	0.017	0.000
8	suction-side	0.010	0.019	0.000
9	suction-side	0.013	0.022	0.000
10	suction-side	0.015	0.024	0.000
11	suction-side	0.017	0.026	0.000
12	suction-side	0.020	0.028	0.000
13	suction-side	0.023	0.030	0.000
14	suction-side	0.025	0.033	0.000
15	suction-side	0.028	0.035	0.000
16	suction-side	0.030	0.037	0.000
17	suction-side	0.033	0.039	0.000
18	suction-side	0.036	0.041	0.000
19	suction-side	0.038	0.043	0.000
20	suction-side	0.041	0.044	0.000
21	suction-side	0.044	0.046	0.000
22	suction-side	0.046	0.048	0.000
23	suction-side	0.049	0.050	0.000
24	suction-side	0.052	0.052	0.000
25	suction-side	0.055	0.053	0.000

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
26	suction-side	0.058	0.055	0.000
27	suction-side	0.060	0.057	0.000
28	suction-side	0.063	0.059	0.000
29	suction-side	0.066	0.060	0.000
30	suction-side	0.069	0.062	0.000
31	suction-side	0.072	0.063	0.000
32	suction-side	0.075	0.065	0.000
33	suction-side	0.078	0.066	0.000
34	suction-side	0.081	0.068	0.000
35	suction-side	0.084	0.069	0.000
36	suction-side	0.087	0.070	0.000
37	suction-side	0.090	0.072	0.000
38	suction-side	0.093	0.073	0.000
39	suction-side	0.096	0.074	0.000
40	suction-side	0.099	0.075	0.000
41	suction-side	0.102	0.076	0.000
42	suction-side	0.105	0.078	0.000
43	suction-side	0.108	0.078	0.000
44	suction-side	0.112	0.079	0.000
45	suction-side	0.115	0.080	0.000
46	suction-side	0.118	0.081	0.000
47	suction-side	0.121	0.082	0.000
48	suction-side	0.125	0.082	0.000
49	suction-side	0.128	0.083	0.000
50	suction-side	0.131	0.083	0.000
51	suction-side	0.134	0.084	0.000
52	suction-side	0.138	0.084	0.000
53	suction-side	0.141	0.084	0.000
54	suction-side	0.144	0.084	0.000
55	suction-side	0.148	0.084	0.000
56	suction-side	0.151	0.084	0.000
57	suction-side	0.154	0.084	0.000
58	suction-side	0.158	0.083	0.000
59	suction-side	0.161	0.083	0.000
60	suction-side	0.164	0.082	0.000
61	suction-side	0.167	0.081	0.000
62	suction-side	0.170	0.080	0.000
63	suction-side	0.174	0.079	0.000
64	suction-side	0.177	0.078	0.000
65	suction-side	0.180	0.077	0.000
66	suction-side	0.183	0.075	0.000
67	suction-side	0.186	0.074	0.000
68	suction-side	0.188	0.072	0.000
69	suction-side	0.191	0.070	0.000
70	suction-side	0.194	0.068	0.000
71	suction-side	0.197	0.066	0.000
72	suction-side	0.199	0.064	0.000
73	suction-side	0.202	0.062	0.000
74	suction-side	0.204	0.060	0.000
75	suction-side	0.207	0.058	0.000
76	suction-side	0.209	0.055	0.000
77	suction-side	0.211	0.053	0.000
78	suction-side	0.213	0.050	0.000
79	suction-side	0.216	0.048	0.000
80	suction-side	0.218	0.045	0.000
81	suction-side	0.220	0.043	0.000
82	suction-side	0.222	0.040	0.000
83	suction-side	0.224	0.038	0.000
84	suction-side	0.226	0.035	0.000
85	suction-side	0.228	0.032	0.000
86	suction-side	0.230	0.030	0.000
87	suction-side	0.232	0.027	0.000
88	suction-side	0.234	0.024	0.000
89	suction-side	0.236	0.022	0.000
90	suction-side	0.238	0.019	0.000
91	suction-side	0.240	0.017	0.000
92	suction-side	0.243	0.014	0.000
93	suction-side	0.245	0.011	0.000
94	suction-side	0.247	0.009	0.000
95	suction-side	0.248	0.003	0.000
96	suction-side	0.248	0.003	0.000
97	suction-side	0.248	0.004	0.000
98	suction-side	0.248	0.006	0.000
99	suction-side	0.249	0.005	0.000
100	suction-side	0.249	0.005	0.000
101	pressure-side	0.000	0.000	0.000

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
102	pressure-side	0.003	0.000	0.000
103	pressure-side	0.005	0.000	0.000
104	pressure-side	0.008	0.001	0.000
105	pressure-side	0.011	0.003	0.000
106	pressure-side	0.013	0.004	0.000
107	pressure-side	0.016	0.005	0.000
108	pressure-side	0.018	0.006	0.000
109	pressure-side	0.021	0.008	0.000
110	pressure-side	0.023	0.009	0.000
111	pressure-side	0.026	0.010	0.000
112	pressure-side	0.028	0.011	0.000
113	pressure-side	0.031	0.013	0.000
114	pressure-side	0.033	0.014	0.000
115	pressure-side	0.036	0.015	0.000
116	pressure-side	0.038	0.016	0.000
117	pressure-side	0.041	0.017	0.000
118	pressure-side	0.044	0.019	0.000
119	pressure-side	0.046	0.020	0.000
120	pressure-side	0.049	0.021	0.000
121	pressure-side	0.051	0.022	0.000
122	pressure-side	0.054	0.023	0.000
123	pressure-side	0.056	0.024	0.000
124	pressure-side	0.059	0.025	0.000
125	pressure-side	0.062	0.026	0.000
126	pressure-side	0.064	0.027	0.000
127	pressure-side	0.067	0.028	0.000
128	pressure-side	0.070	0.029	0.000
129	pressure-side	0.072	0.030	0.000
130	pressure-side	0.075	0.031	0.000
131	pressure-side	0.078	0.032	0.000
132	pressure-side	0.080	0.033	0.000
133	pressure-side	0.083	0.034	0.000
134	pressure-side	0.086	0.034	0.000
135	pressure-side	0.088	0.035	0.000
136	pressure-side	0.091	0.036	0.000
137	pressure-side	0.094	0.037	0.000
138	pressure-side	0.096	0.037	0.000
139	pressure-side	0.099	0.038	0.000
140	pressure-side	0.102	0.039	0.000
141	pressure-side	0.105	0.039	0.000
142	pressure-side	0.107	0.040	0.000
143	pressure-side	0.110	0.040	0.000
144	pressure-side	0.113	0.041	0.000
145	pressure-side	0.116	0.041	0.000
146	pressure-side	0.119	0.041	0.000
147	pressure-side	0.121	0.042	0.000
148	pressure-side	0.124	0.042	0.000
149	pressure-side	0.127	0.042	0.000
150	pressure-side	0.130	0.043	0.000
151	pressure-side	0.133	0.043	0.000
152	pressure-side	0.135	0.043	0.000
153	pressure-side	0.138	0.043	0.000
154	pressure-side	0.141	0.043	0.000
155	pressure-side	0.144	0.043	0.000
156	pressure-side	0.147	0.043	0.000
157	pressure-side	0.149	0.043	0.000
158	pressure-side	0.152	0.043	0.000
159	pressure-side	0.155	0.042	0.000
160	pressure-side	0.158	0.042	0.000
161	pressure-side	0.161	0.042	0.000
162	pressure-side	0.163	0.042	0.000
163	pressure-side	0.166	0.041	0.000
164	pressure-side	0.169	0.041	0.000
165	pressure-side	0.172	0.040	0.000
166	pressure-side	0.174	0.040	0.000
167	pressure-side	0.177	0.039	0.000
168	pressure-side	0.180	0.039	0.000
169	pressure-side	0.183	0.038	0.000
170	pressure-side	0.185	0.037	0.000
171	pressure-side	0.188	0.037	0.000
172	pressure-side	0.191	0.036	0.000
173	pressure-side	0.193	0.035	0.000
174	pressure-side	0.196	0.034	0.000
175	pressure-side	0.199	0.033	0.000
176	pressure-side	0.201	0.032	0.000
177	pressure-side	0.204	0.031	0.000
178	pressure-side	0.207	0.030	0.000
179	pressure-side	0.209	0.029	0.000
180	pressure-side	0.212	0.028	0.000
181	pressure-side	0.214	0.027	0.000
182	pressure-side	0.217	0.025	0.000
183	pressure-side	0.219	0.024	0.000
184	pressure-side	0.222	0.023	0.000
185	pressure-side	0.224	0.021	0.000
186	pressure-side	0.226	0.019	0.000
187	pressure-side	0.228	0.018	0.000
188	pressure-side	0.231	0.016	0.000
189	pressure-side	0.233	0.014	0.000
190	pressure-side	0.235	0.012	0.000
191	pressure-side	0.237	0.010	0.000
192	pressure-side	0.239	0.008	0.000
193	pressure-side	0.241	0.006	0.000
194	pressure-side	0.243	0.004	0.000
195	pressure-side	0.245	0.002	0.000
196	pressure-side	0.245	0.002	0.000
197	pressure-side	0.246	0.002	0.000
198	pressure-side	0.247	0.002	0.000
199	pressure-side	0.248	0.003	0.000
200	pressure-side	0.248	0.003	0.000
1	suction-side	0.009	0.018	0.100
2	suction-side	0.009	0.015	0.100
3	suction-side	0.010	0.021	0.100
4	suction-side	0.012	0.023	0.100
5	suction-side	0.014	0.026	0.100
6	suction-side	0.017	0.028	0.100
7	suction-side	0.019	0.030	0.100
8	suction-side	0.021	0.033	0.100
9	suction-side	0.023	0.035	0.100
10	suction-side	0.026	0.037	0.100
11	suction-side	0.028	0.039	0.100
12	suction-side	0.031	0.041	0.100
13	suction-side	0.033	0.043	0.100
14	suction-side	0.035	0.045	0.100
15	suction-side	0.038	0.047	0.100
16	suction-side	0.040	0.048	0.100
17	suction-side	0.043	0.050	0.100
18	suction-side	0.046	0.052	0.100
19	suction-side	0.048	0.054	0.100
20	suction-side	0.051	0.055	0.100
21	suction-side	0.053	0.057	0.100
22	suction-side	0.056	0.059	0.100
23	suction-side	0.059	0.060	0.100
24	suction-side	0.062	0.062	0.100
25	suction-side	0.064	0.063	0.100
26	suction-side	0.067	0.065	0.100
27	suction-side	0.070	0.066	0.100
28	suction-side	0.073	0.067	0.100
29	suction-side	0.076	0.069	0.100
30	suction-side	0.078	0.070	0.100
31	suction-side	0.081	0.071	0.100
32	suction-side	0.084	0.072	0.100
33	suction-side	0.087	0.073	0.100
34	suction-side	0.090	0.074	0.100
35	suction-side	0.093	0.075	0.100
36	suction-side	0.096	0.076	0.100
37	suction-side	0.099	0.077	0.100
38	suction-side	0.102	0.078	0.100
39	suction-side	0.105	0.078	0.100
40	suction-side	0.108	0.079	0.100
41	suction-side	0.111	0.080	0.100
42	suction-side	0.115	0.080	0.100
43	suction-side	0.118	0.081	0.100
44	suction-side	0.121	0.081	0.100
45	suction-side	0.124	0.081	0.100
46	suction-side	0.127	0.081	0.100
47	suction-side	0.130	0.082	0.100
48	suction-side	0.133	0.082	0.100
49	suction-side	0.137	0.082	0.100
50	suction-side	0.140	0.081	0.100
51	suction-side	0.143	0.081	0.100
52	suction-side	0.146	0.081	0.100
53	suction-side	0.149	0.080	0.100

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
54	suction-side	0.152	0.080	0.100
55	suction-side	0.155	0.079	0.100
56	suction-side	0.158	0.079	0.100
57	suction-side	0.161	0.078	0.100
58	suction-side	0.164	0.077	0.100
59	suction-side	0.167	0.076	0.100
60	suction-side	0.170	0.075	0.100
61	suction-side	0.173	0.074	0.100
62	suction-side	0.176	0.072	0.100
63	suction-side	0.179	0.071	0.100
64	suction-side	0.182	0.069	0.100
65	suction-side	0.184	0.068	0.100
66	suction-side	0.187	0.066	0.100
67	suction-side	0.190	0.064	0.100
68	suction-side	0.192	0.062	0.100
69	suction-side	0.195	0.060	0.100
70	suction-side	0.197	0.058	0.100
71	suction-side	0.199	0.056	0.100
72	suction-side	0.202	0.054	0.100
73	suction-side	0.204	0.052	0.100
74	suction-side	0.206	0.050	0.100
75	suction-side	0.208	0.048	0.100
76	suction-side	0.211	0.045	0.100
77	suction-side	0.213	0.043	0.100
78	suction-side	0.215	0.041	0.100
79	suction-side	0.217	0.038	0.100
80	suction-side	0.219	0.036	0.100
81	suction-side	0.221	0.034	0.100
82	suction-side	0.223	0.031	0.100
83	suction-side	0.225	0.029	0.100
84	suction-side	0.227	0.026	0.100
85	suction-side	0.228	0.024	0.100
86	suction-side	0.230	0.021	0.100
87	suction-side	0.232	0.019	0.100
88	suction-side	0.234	0.016	0.100
89	suction-side	0.236	0.014	0.100
90	suction-side	0.238	0.011	0.100
91	suction-side	0.240	0.009	0.100
92	suction-side	0.242	0.006	0.100
93	suction-side	0.244	0.004	0.100
94	suction-side	0.245	0.001	0.100
95	suction-side	0.247	−0.004	0.100
96	suction-side	0.247	−0.004	0.100
97	suction-side	0.247	−0.003	0.100
98	suction-side	0.247	−0.001	0.100
99	suction-side	0.247	−0.003	0.100
100	suction-side	0.247	−0.002	0.100
101	pressure-side	0.009	0.015	0.100
102	pressure-side	0.012	0.014	0.100
103	pressure-side	0.014	0.014	0.100
104	pressure-side	0.017	0.015	0.100
105	pressure-side	0.020	0.015	0.100
106	pressure-side	0.022	0.016	0.100
107	pressure-side	0.025	0.017	0.100
108	pressure-side	0.027	0.018	0.100
109	pressure-side	0.030	0.019	0.100
110	pressure-side	0.032	0.020	0.100
111	pressure-side	0.035	0.022	0.100
112	pressure-side	0.037	0.023	0.100
113	pressure-side	0.040	0.024	0.100
114	pressure-side	0.042	0.025	0.100
115	pressure-side	0.045	0.026	0.100
116	pressure-side	0.047	0.027	0.100
117	pressure-side	0.050	0.028	0.100
118	pressure-side	0.052	0.029	0.100
119	pressure-side	0.055	0.030	0.100
120	pressure-side	0.057	0.031	0.100
121	pressure-side	0.060	0.032	0.100
122	pressure-side	0.062	0.033	0.100
123	pressure-side	0.065	0.034	0.100
124	pressure-side	0.068	0.035	0.100
125	pressure-side	0.070	0.036	0.100
126	pressure-side	0.073	0.037	0.100
127	pressure-side	0.075	0.038	0.100
128	pressure-side	0.078	0.038	0.100
129	pressure-side	0.081	0.039	0.100

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
130	pressure-side	0.083	0.040	0.100
131	pressure-side	0.086	0.041	0.100
132	pressure-side	0.088	0.041	0.100
133	pressure-side	0.091	0.042	0.100
134	pressure-side	0.094	0.042	0.100
135	pressure-side	0.096	0.043	0.100
136	pressure-side	0.099	0.043	0.100
137	pressure-side	0.102	0.044	0.100
138	pressure-side	0.104	0.044	0.100
139	pressure-side	0.107	0.045	0.100
140	pressure-side	0.110	0.045	0.100
141	pressure-side	0.112	0.045	0.100
142	pressure-side	0.115	0.046	0.100
143	pressure-side	0.118	0.046	0.100
144	pressure-side	0.121	0.046	0.100
145	pressure-side	0.123	0.046	0.100
146	pressure-side	0.126	0.046	0.100
147	pressure-side	0.129	0.047	0.100
148	pressure-side	0.131	0.047	0.100
149	pressure-side	0.134	0.047	0.100
150	pressure-side	0.137	0.047	0.100
151	pressure-side	0.140	0.046	0.100
152	pressure-side	0.142	0.046	0.100
153	pressure-side	0.145	0.046	0.100
154	pressure-side	0.148	0.046	0.100
155	pressure-side	0.151	0.046	0.100
156	pressure-side	0.153	0.045	0.100
157	pressure-side	0.156	0.045	0.100
158	pressure-side	0.159	0.045	0.100
159	pressure-side	0.161	0.044	0.100
160	pressure-side	0.164	0.044	0.100
161	pressure-side	0.167	0.043	0.100
162	pressure-side	0.170	0.043	0.100
163	pressure-side	0.172	0.042	0.100
164	pressure-side	0.175	0.041	0.100
165	pressure-side	0.177	0.041	0.100
166	pressure-side	0.180	0.040	0.100
167	pressure-side	0.183	0.039	0.100
168	pressure-side	0.185	0.038	0.100
169	pressure-side	0.188	0.037	0.100
170	pressure-side	0.190	0.036	0.100
171	pressure-side	0.193	0.035	0.100
172	pressure-side	0.195	0.034	0.100
173	pressure-side	0.198	0.033	0.100
174	pressure-side	0.200	0.032	0.100
175	pressure-side	0.203	0.031	0.100
176	pressure-side	0.205	0.029	0.100
177	pressure-side	0.208	0.028	0.100
178	pressure-side	0.210	0.027	0.100
179	pressure-side	0.212	0.025	0.100
180	pressure-side	0.214	0.024	0.100
181	pressure-side	0.217	0.022	0.100
182	pressure-side	0.219	0.020	0.100
183	pressure-side	0.221	0.019	0.100
184	pressure-side	0.223	0.017	0.100
185	pressure-side	0.225	0.015	0.100
186	pressure-side	0.227	0.013	0.100
187	pressure-side	0.229	0.011	0.100
188	pressure-side	0.231	0.010	0.100
189	pressure-side	0.233	0.008	0.100
190	pressure-side	0.235	0.006	0.100
191	pressure-side	0.237	0.004	0.100
192	pressure-side	0.238	0.001	0.100
193	pressure-side	0.240	−0.001	0.100
194	pressure-side	0.242	−0.003	0.100
195	pressure-side	0.244	−0.005	0.100
196	pressure-side	0.244	−0.005	0.100
197	pressure-side	0.245	−0.005	0.100
198	pressure-side	0.246	−0.005	0.100
199	pressure-side	0.247	−0.004	0.100
200	pressure-side	0.247	−0.004	0.100
1	suction-side	0.018	0.031	0.200
2	suction-side	0.018	0.034	0.200
3	suction-side	0.020	0.036	0.200
4	suction-side	0.022	0.039	0.200
5	suction-side	0.024	0.041	0.200

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
6	suction-side	0.026	0.043	0.200
7	suction-side	0.028	0.045	0.200
8	suction-side	0.030	0.047	0.200
9	suction-side	0.032	0.049	0.200
10	suction-side	0.035	0.050	0.200
11	suction-side	0.037	0.052	0.200
12	suction-side	0.039	0.054	0.200
13	suction-side	0.042	0.056	0.200
14	suction-side	0.044	0.057	0.200
15	suction-side	0.047	0.059	0.200
16	suction-side	0.049	0.060	0.200
17	suction-side	0.052	0.062	0.200
18	suction-side	0.054	0.063	0.200
19	suction-side	0.057	0.065	0.200
20	suction-side	0.059	0.066	0.200
21	suction-side	0.062	0.068	0.200
22	suction-side	0.065	0.069	0.200
23	suction-side	0.067	0.070	0.200
24	suction-side	0.070	0.071	0.200
25	suction-side	0.073	0.072	0.200
26	suction-side	0.075	0.073	0.200
27	suction-side	0.078	0.074	0.200
28	suction-side	0.081	0.075	0.200
29	suction-side	0.084	0.076	0.200
30	suction-side	0.087	0.077	0.200
31	suction-side	0.089	0.078	0.200
32	suction-side	0.092	0.078	0.200
33	suction-side	0.095	0.079	0.200
34	suction-side	0.098	0.080	0.200
35	suction-side	0.101	0.080	0.200
36	suction-side	0.104	0.081	0.200
37	suction-side	0.107	0.081	0.200
38	suction-side	0.110	0.081	0.200
39	suction-side	0.113	0.081	0.200
40	suction-side	0.116	0.082	0.200
41	suction-side	0.119	0.082	0.200
42	suction-side	0.121	0.082	0.200
43	suction-side	0.124	0.082	0.200
44	suction-side	0.127	0.081	0.200
45	suction-side	0.130	0.081	0.200
46	suction-side	0.133	0.081	0.200
47	suction-side	0.136	0.080	0.200
48	suction-side	0.139	0.080	0.200
49	suction-side	0.142	0.079	0.200
50	suction-side	0.145	0.079	0.200
51	suction-side	0.148	0.078	0.200
52	suction-side	0.150	0.077	0.200
53	suction-side	0.153	0.076	0.200
54	suction-side	0.156	0.075	0.200
55	suction-side	0.159	0.074	0.200
56	suction-side	0.162	0.073	0.200
57	suction-side	0.164	0.072	0.200
58	suction-side	0.167	0.070	0.200
59	suction-side	0.169	0.069	0.200
60	suction-side	0.172	0.068	0.200
61	suction-side	0.174	0.066	0.200
62	suction-side	0.177	0.065	0.200
63	suction-side	0.179	0.063	0.200
64	suction-side	0.182	0.061	0.200
65	suction-side	0.184	0.059	0.200
66	suction-side	0.186	0.057	0.200
67	suction-side	0.189	0.056	0.200
68	suction-side	0.191	0.054	0.200
69	suction-side	0.193	0.052	0.200
70	suction-side	0.195	0.050	0.200
71	suction-side	0.197	0.048	0.200
72	suction-side	0.199	0.046	0.200
73	suction-side	0.201	0.043	0.200
74	suction-side	0.203	0.041	0.200
75	suction-side	0.205	0.039	0.200
76	suction-side	0.207	0.037	0.200
77	suction-side	0.209	0.035	0.200
78	suction-side	0.211	0.032	0.200
79	suction-side	0.213	0.030	0.200
80	suction-side	0.215	0.028	0.200
81	suction-side	0.216	0.026	0.200

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
82	suction-side	0.218	0.023	0.200
83	suction-side	0.220	0.021	0.200
84	suction-side	0.222	0.019	0.200
85	suction-side	0.224	0.016	0.200
86	suction-side	0.225	0.014	0.200
87	suction-side	0.227	0.012	0.200
88	suction-side	0.229	0.009	0.200
89	suction-side	0.231	0.007	0.200
90	suction-side	0.232	0.005	0.200
91	suction-side	0.234	0.002	0.200
92	suction-side	0.236	0.000	0.200
93	suction-side	0.238	−0.002	0.200
94	suction-side	0.239	−0.005	0.200
95	suction-side	0.240	−0.010	0.200
96	suction-side	0.241	−0.009	0.200
97	suction-side	0.241	−0.009	0.200
98	suction-side	0.241	−0.007	0.200
99	suction-side	0.241	−0.008	0.200
100	suction-side	0.241	−0.008	0.200
101	pressure-side	0.018	0.031	0.200
102	pressure-side	0.020	0.030	0.200
103	pressure-side	0.022	0.029	0.200
104	pressure-side	0.025	0.029	0.200
105	pressure-side	0.028	0.030	0.200
106	pressure-side	0.030	0.031	0.200
107	pressure-side	0.033	0.031	0.200
108	pressure-side	0.035	0.032	0.200
109	pressure-side	0.038	0.033	0.200
110	pressure-side	0.040	0.034	0.200
111	pressure-side	0.042	0.034	0.200
112	pressure-side	0.045	0.035	0.200
113	pressure-side	0.047	0.036	0.200
114	pressure-side	0.050	0.037	0.200
115	pressure-side	0.052	0.038	0.200
116	pressure-side	0.055	0.039	0.200
117	pressure-side	0.057	0.039	0.200
118	pressure-side	0.060	0.040	0.200
119	pressure-side	0.062	0.041	0.200
120	pressure-side	0.065	0.042	0.200
121	pressure-side	0.067	0.042	0.200
122	pressure-side	0.070	0.043	0.200
123	pressure-side	0.072	0.044	0.200
124	pressure-side	0.075	0.044	0.200
125	pressure-side	0.077	0.045	0.200
126	pressure-side	0.080	0.045	0.200
127	pressure-side	0.082	0.046	0.200
128	pressure-side	0.085	0.046	0.200
129	pressure-side	0.087	0.047	0.200
130	pressure-side	0.090	0.047	0.200
131	pressure-side	0.092	0.048	0.200
132	pressure-side	0.095	0.048	0.200
133	pressure-side	0.098	0.048	0.200
134	pressure-side	0.100	0.048	0.200
135	pressure-side	0.103	0.049	0.200
136	pressure-side	0.105	0.049	0.200
137	pressure-side	0.108	0.049	0.200
138	pressure-side	0.110	0.049	0.200
139	pressure-side	0.113	0.049	0.200
140	pressure-side	0.116	0.049	0.200
141	pressure-side	0.118	0.049	0.200
142	pressure-side	0.121	0.049	0.200
143	pressure-side	0.123	0.049	0.200
144	pressure-side	0.126	0.049	0.200
145	pressure-side	0.129	0.049	0.200
146	pressure-side	0.131	0.049	0.200
147	pressure-side	0.134	0.048	0.200
148	pressure-side	0.136	0.048	0.200
149	pressure-side	0.139	0.048	0.200
150	pressure-side	0.141	0.047	0.200
151	pressure-side	0.144	0.047	0.200
152	pressure-side	0.146	0.047	0.200
153	pressure-side	0.149	0.046	0.200
154	pressure-side	0.152	0.046	0.200
155	pressure-side	0.154	0.045	0.200
156	pressure-side	0.157	0.045	0.200
157	pressure-side	0.159	0.044	0.200

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
158	pressure-side	0.162	0.043	0.200
159	pressure-side	0.164	0.043	0.200
160	pressure-side	0.166	0.042	0.200
161	pressure-side	0.169	0.041	0.200
162	pressure-side	0.171	0.040	0.200
163	pressure-side	0.174	0.039	0.200
164	pressure-side	0.176	0.039	0.200
165	pressure-side	0.179	0.038	0.200
166	pressure-side	0.181	0.037	0.200
167	pressure-side	0.183	0.036	0.200
168	pressure-side	0.186	0.035	0.200
169	pressure-side	0.188	0.033	0.200
170	pressure-side	0.190	0.032	0.200
171	pressure-side	0.193	0.031	0.200
172	pressure-side	0.195	0.030	0.200
173	pressure-side	0.197	0.028	0.200
174	pressure-side	0.199	0.027	0.200
175	pressure-side	0.201	0.026	0.200
176	pressure-side	0.203	0.024	0.200
177	pressure-side	0.206	0.023	0.200
178	pressure-side	0.208	0.021	0.200
179	pressure-side	0.210	0.020	0.200
180	pressure-side	0.211	0.018	0.200
181	pressure-side	0.213	0.016	0.200
182	pressure-side	0.215	0.015	0.200
183	pressure-side	0.217	0.013	0.200
184	pressure-side	0.219	0.011	0.200
185	pressure-side	0.221	0.009	0.200
186	pressure-side	0.223	0.007	0.200
187	pressure-side	0.224	0.005	0.200
188	pressure-side	0.226	0.004	0.200
189	pressure-side	0.228	0.002	0.200
190	pressure-side	0.229	0.000	0.200
191	pressure-side	0.231	−0.002	0.200
192	pressure-side	0.233	−0.004	0.200
193	pressure-side	0.234	−0.006	0.200
194	pressure-side	0.236	−0.008	0.200
195	pressure-side	0.238	−0.010	0.200
196	pressure-side	0.238	−0.010	0.200
197	pressure-side	0.239	−0.010	0.200
198	pressure-side	0.240	−0.010	0.200
199	pressure-side	0.240	−0.010	0.200
200	pressure-side	0.240	−0.010	0.200
1	suction-side	0.026	0.048	0.300
2	suction-side	0.027	0.050	0.300
3	suction-side	0.028	0.053	0.300
4	suction-side	0.030	0.055	0.300
5	suction-side	0.032	0.056	0.300
6	suction-side	0.034	0.058	0.300
7	suction-side	0.036	0.060	0.300
8	suction-side	0.038	0.062	0.300
9	suction-side	0.040	0.063	0.300
10	suction-side	0.043	0.065	0.300
11	suction-side	0.045	0.066	0.300
12	suction-side	0.047	0.068	0.300
13	suction-side	0.050	0.069	0.300
14	suction-side	0.052	0.070	0.300
15	suction-side	0.054	0.072	0.300
16	suction-side	0.057	0.073	0.300
17	suction-side	0.059	0.074	0.300
18	suction-side	0.062	0.075	0.300
19	suction-side	0.064	0.076	0.300
20	suction-side	0.067	0.077	0.300
21	suction-side	0.069	0.078	0.300
22	suction-side	0.072	0.079	0.300
23	suction-side	0.075	0.079	0.300
24	suction-side	0.077	0.080	0.300
25	suction-side	0.080	0.081	0.300
26	suction-side	0.083	0.081	0.300
27	suction-side	0.085	0.082	0.300
28	suction-side	0.088	0.082	0.300
29	suction-side	0.091	0.083	0.300
30	suction-side	0.093	0.083	0.300
31	suction-side	0.096	0.083	0.300
32	suction-side	0.099	0.084	0.300
33	suction-side	0.101	0.084	0.300

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
34	suction-side	0.104	0.084	0.300
35	suction-side	0.107	0.084	0.300
36	suction-side	0.110	0.084	0.300
37	suction-side	0.112	0.084	0.300
38	suction-side	0.115	0.084	0.300
39	suction-side	0.118	0.083	0.300
40	suction-side	0.120	0.083	0.300
41	suction-side	0.123	0.083	0.300
42	suction-side	0.126	0.082	0.300
43	suction-side	0.128	0.081	0.300
44	suction-side	0.131	0.081	0.300
45	suction-side	0.134	0.080	0.300
46	suction-side	0.136	0.079	0.300
47	suction-side	0.139	0.078	0.300
48	suction-side	0.141	0.077	0.300
49	suction-side	0.144	0.076	0.300
50	suction-side	0.146	0.075	0.300
51	suction-side	0.149	0.074	0.300
52	suction-side	0.151	0.073	0.300
53	suction-side	0.154	0.072	0.300
54	suction-side	0.156	0.070	0.300
55	suction-side	0.158	0.069	0.300
56	suction-side	0.161	0.067	0.300
57	suction-side	0.163	0.066	0.300
58	suction-side	0.165	0.064	0.300
59	suction-side	0.167	0.063	0.300
60	suction-side	0.169	0.061	0.300
61	suction-side	0.171	0.059	0.300
62	suction-side	0.173	0.057	0.300
63	suction-side	0.175	0.055	0.300
64	suction-side	0.177	0.054	0.300
65	suction-side	0.179	0.052	0.300
66	suction-side	0.181	0.050	0.300
67	suction-side	0.183	0.048	0.300
68	suction-side	0.185	0.046	0.300
69	suction-side	0.187	0.044	0.300
70	suction-side	0.189	0.042	0.300
71	suction-side	0.191	0.040	0.300
72	suction-side	0.192	0.038	0.300
73	suction-side	0.194	0.036	0.300
74	suction-side	0.196	0.034	0.300
75	suction-side	0.198	0.032	0.300
76	suction-side	0.199	0.029	0.300
77	suction-side	0.201	0.027	0.300
78	suction-side	0.203	0.025	0.300
79	suction-side	0.205	0.023	0.300
80	suction-side	0.206	0.021	0.300
81	suction-side	0.208	0.019	0.300
82	suction-side	0.210	0.017	0.300
83	suction-side	0.211	0.015	0.300
84	suction-side	0.213	0.012	0.300
85	suction-side	0.215	0.010	0.300
86	suction-side	0.216	0.008	0.300
87	suction-side	0.218	0.006	0.300
88	suction-side	0.220	0.004	0.300
89	suction-side	0.221	0.001	0.300
90	suction-side	0.223	−0.001	0.300
91	suction-side	0.225	−0.003	0.300
92	suction-side	0.226	−0.005	0.300
93	suction-side	0.228	−0.007	0.300
94	suction-side	0.229	−0.010	0.300
95	suction-side	0.230	−0.014	0.300
96	suction-side	0.231	−0.014	0.300
97	suction-side	0.231	−0.013	0.300
98	suction-side	0.231	−0.012	0.300
99	suction-side	0.231	−0.013	0.300
100	suction-side	0.231	−0.012	0.300
101	pressure-side	0.026	0.048	0.300
102	pressure-side	0.028	0.046	0.300
103	pressure-side	0.031	0.046	0.300
104	pressure-side	0.033	0.046	0.300
105	pressure-side	0.035	0.046	0.300
106	pressure-side	0.038	0.047	0.300
107	pressure-side	0.040	0.047	0.300
108	pressure-side	0.042	0.048	0.300
109	pressure-side	0.045	0.048	0.300

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
110	pressure-side	0.047	0.048	0.300
111	pressure-side	0.049	0.049	0.300
112	pressure-side	0.052	0.049	0.300
113	pressure-side	0.054	0.050	0.300
114	pressure-side	0.057	0.050	0.300
115	pressure-side	0.059	0.050	0.300
116	pressure-side	0.061	0.051	0.300
117	pressure-side	0.064	0.051	0.300
118	pressure-side	0.066	0.051	0.300
119	pressure-side	0.068	0.052	0.300
120	pressure-side	0.071	0.052	0.300
121	pressure-side	0.073	0.052	0.300
122	pressure-side	0.075	0.052	0.300
123	pressure-side	0.078	0.052	0.300
124	pressure-side	0.080	0.053	0.300
125	pressure-side	0.083	0.053	0.300
126	pressure-side	0.085	0.053	0.300
127	pressure-side	0.087	0.053	0.300
128	pressure-side	0.090	0.053	0.300
129	pressure-side	0.092	0.053	0.300
130	pressure-side	0.095	0.053	0.300
131	pressure-side	0.097	0.053	0.300
132	pressure-side	0.099	0.053	0.300
133	pressure-side	0.102	0.052	0.300
134	pressure-side	0.104	0.052	0.300
135	pressure-side	0.107	0.052	0.300
136	pressure-side	0.109	0.052	0.300
137	pressure-side	0.111	0.052	0.300
138	pressure-side	0.114	0.051	0.300
139	pressure-side	0.116	0.051	0.300
140	pressure-side	0.118	0.051	0.300
141	pressure-side	0.121	0.050	0.300
142	pressure-side	0.123	0.050	0.300
143	pressure-side	0.125	0.049	0.300
144	pressure-side	0.128	0.049	0.300
145	pressure-side	0.130	0.048	0.300
146	pressure-side	0.132	0.048	0.300
147	pressure-side	0.135	0.047	0.300
148	pressure-side	0.137	0.047	0.300
149	pressure-side	0.139	0.046	0.300
150	pressure-side	0.142	0.046	0.300
151	pressure-side	0.144	0.045	0.300
152	pressure-side	0.146	0.044	0.300
153	pressure-side	0.149	0.043	0.300
154	pressure-side	0.151	0.043	0.300
155	pressure-side	0.153	0.042	0.300
156	pressure-side	0.155	0.041	0.300
157	pressure-side	0.157	0.040	0.300
158	pressure-side	0.160	0.039	0.300
159	pressure-side	0.162	0.038	0.300
160	pressure-side	0.164	0.037	0.300
161	pressure-side	0.166	0.036	0.300
162	pressure-side	0.168	0.035	0.300
163	pressure-side	0.170	0.034	0.300
164	pressure-side	0.173	0.033	0.300
165	pressure-side	0.175	0.032	0.300
166	pressure-side	0.177	0.031	0.300
167	pressure-side	0.179	0.030	0.300
168	pressure-side	0.181	0.029	0.300
169	pressure-side	0.183	0.027	0.300
170	pressure-side	0.185	0.026	0.300
171	pressure-side	0.187	0.025	0.300
172	pressure-side	0.189	0.023	0.300
173	pressure-side	0.191	0.022	0.300
174	pressure-side	0.193	0.021	0.300
175	pressure-side	0.195	0.019	0.300
176	pressure-side	0.196	0.018	0.300
177	pressure-side	0.198	0.016	0.300
178	pressure-side	0.200	0.015	0.300
179	pressure-side	0.202	0.013	0.300
180	pressure-side	0.204	0.012	0.300
181	pressure-side	0.205	0.010	0.300
182	pressure-side	0.207	0.008	0.300
183	pressure-side	0.209	0.007	0.300
184	pressure-side	0.210	0.005	0.300
185	pressure-side	0.212	0.003	0.300

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
186	pressure-side	0.214	0.001	0.300
187	pressure-side	0.215	0.000	0.300
188	pressure-side	0.217	−0.002	0.300
189	pressure-side	0.218	−0.004	0.300
190	pressure-side	0.220	−0.006	0.300
191	pressure-side	0.222	−0.007	0.300
192	pressure-side	0.223	−0.009	0.300
193	pressure-side	0.225	−0.011	0.300
194	pressure-side	0.226	−0.013	0.300
195	pressure-side	0.228	−0.015	0.300
196	pressure-side	0.228	−0.015	0.300
197	pressure-side	0.229	−0.015	0.300
198	pressure-side	0.230	−0.015	0.300
199	pressure-side	0.230	−0.014	0.300
200	pressure-side	0.230	−0.014	0.300
1	suction-side	0.032	0.064	0.400
2	suction-side	0.032	0.067	0.400
3	suction-side	0.034	0.069	0.400
4	suction-side	0.036	0.071	0.400
5	suction-side	0.038	0.073	0.400
6	suction-side	0.040	0.074	0.400
7	suction-side	0.042	0.076	0.400
8	suction-side	0.044	0.077	0.400
9	suction-side	0.047	0.078	0.400
10	suction-side	0.049	0.079	0.400
11	suction-side	0.051	0.081	0.400
12	suction-side	0.054	0.082	0.400
13	suction-side	0.056	0.083	0.400
14	suction-side	0.058	0.084	0.400
15	suction-side	0.061	0.084	0.400
16	suction-side	0.063	0.085	0.400
17	suction-side	0.066	0.086	0.400
18	suction-side	0.068	0.086	0.400
19	suction-side	0.071	0.087	0.400
20	suction-side	0.073	0.087	0.400
21	suction-side	0.076	0.088	0.400
22	suction-side	0.078	0.088	0.400
23	suction-side	0.081	0.088	0.400
24	suction-side	0.084	0.089	0.400
25	suction-side	0.086	0.089	0.400
26	suction-side	0.089	0.089	0.400
27	suction-side	0.091	0.089	0.400
28	suction-side	0.094	0.089	0.400
29	suction-side	0.097	0.089	0.400
30	suction-side	0.099	0.089	0.400
31	suction-side	0.102	0.088	0.400
32	suction-side	0.104	0.088	0.400
33	suction-side	0.107	0.088	0.400
34	suction-side	0.109	0.087	0.400
35	suction-side	0.112	0.087	0.400
36	suction-side	0.114	0.086	0.400
37	suction-side	0.117	0.086	0.400
38	suction-side	0.119	0.085	0.400
39	suction-side	0.122	0.084	0.400
40	suction-side	0.124	0.083	0.400
41	suction-side	0.127	0.083	0.400
42	suction-side	0.129	0.082	0.400
43	suction-side	0.131	0.081	0.400
44	suction-side	0.134	0.079	0.400
45	suction-side	0.136	0.078	0.400
46	suction-side	0.138	0.077	0.400
47	suction-side	0.141	0.076	0.400
48	suction-side	0.143	0.074	0.400
49	suction-side	0.145	0.073	0.400
50	suction-side	0.147	0.071	0.400
51	suction-side	0.149	0.070	0.400
52	suction-side	0.151	0.068	0.400
53	suction-side	0.153	0.067	0.400
54	suction-side	0.155	0.065	0.400
55	suction-side	0.157	0.063	0.400
56	suction-side	0.159	0.062	0.400
57	suction-side	0.161	0.060	0.400
58	suction-side	0.163	0.058	0.400
59	suction-side	0.165	0.056	0.400
60	suction-side	0.166	0.054	0.400
61	suction-side	0.168	0.053	0.400

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
62	suction-side	0.170	0.051	0.400
63	suction-side	0.172	0.049	0.400
64	suction-side	0.173	0.047	0.400
65	suction-side	0.175	0.045	0.400
66	suction-side	0.177	0.043	0.400
67	suction-side	0.178	0.041	0.400
68	suction-side	0.180	0.039	0.400
69	suction-side	0.182	0.037	0.400
70	suction-side	0.183	0.035	0.400
71	suction-side	0.185	0.033	0.400
72	suction-side	0.186	0.031	0.400
73	suction-side	0.188	0.029	0.400
74	suction-side	0.190	0.027	0.400
75	suction-side	0.191	0.025	0.400
76	suction-side	0.193	0.023	0.400
77	suction-side	0.195	0.021	0.400
78	suction-side	0.196	0.019	0.400
79	suction-side	0.198	0.017	0.400
80	suction-side	0.199	0.015	0.400
81	suction-side	0.201	0.013	0.400
82	suction-side	0.202	0.011	0.400
83	suction-side	0.204	0.009	0.400
84	suction-side	0.206	0.006	0.400
85	suction-side	0.207	0.004	0.400
86	suction-side	0.209	0.002	0.400
87	suction-side	0.210	0.000	0.400
88	suction-side	0.212	−0.002	0.400
89	suction-side	0.213	−0.004	0.400
90	suction-side	0.215	−0.006	0.400
91	suction-side	0.216	−0.008	0.400
92	suction-side	0.218	−0.010	0.400
93	suction-side	0.220	−0.012	0.400
94	suction-side	0.221	−0.014	0.400
95	suction-side	0.222	−0.019	0.400
96	suction-side	0.222	−0.018	0.400
97	suction-side	0.222	−0.018	0.400
98	suction-side	0.222	−0.016	0.400
99	suction-side	0.223	−0.018	0.400
100	suction-side	0.223	−0.017	0.400
101	pressure-side	0.032	0.064	0.400
102	pressure-side	0.034	0.063	0.400
103	pressure-side	0.036	0.063	0.400
104	pressure-side	0.038	0.063	0.400
105	pressure-side	0.041	0.063	0.400
106	pressure-side	0.043	0.063	0.400
107	pressure-side	0.045	0.063	0.400
108	pressure-side	0.048	0.064	0.400
109	pressure-side	0.050	0.064	0.400
110	pressure-side	0.052	0.064	0.400
111	pressure-side	0.054	0.064	0.400
112	pressure-side	0.057	0.064	0.400
113	pressure-side	0.059	0.064	0.400
114	pressure-side	0.061	0.064	0.400
115	pressure-side	0.064	0.064	0.400
116	pressure-side	0.066	0.064	0.400
117	pressure-side	0.068	0.064	0.400
118	pressure-side	0.070	0.064	0.400
119	pressure-side	0.073	0.064	0.400
120	pressure-side	0.075	0.064	0.400
121	pressure-side	0.077	0.064	0.400
122	pressure-side	0.080	0.063	0.400
123	pressure-side	0.082	0.063	0.400
124	pressure-side	0.084	0.063	0.400
125	pressure-side	0.086	0.063	0.400
126	pressure-side	0.089	0.062	0.400
127	pressure-side	0.091	0.062	0.400
128	pressure-side	0.093	0.062	0.400
129	pressure-side	0.095	0.061	0.400
130	pressure-side	0.098	0.061	0.400
131	pressure-side	0.100	0.060	0.400
132	pressure-side	0.102	0.060	0.400
133	pressure-side	0.104	0.059	0.400
134	pressure-side	0.107	0.059	0.400
135	pressure-side	0.109	0.058	0.400
136	pressure-side	0.111	0.057	0.400
137	pressure-side	0.113	0.057	0.400

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
138	pressure-side	0.115	0.056	0.400
139	pressure-side	0.118	0.055	0.400
140	pressure-side	0.120	0.055	0.400
141	pressure-side	0.122	0.054	0.400
142	pressure-side	0.124	0.053	0.400
143	pressure-side	0.126	0.052	0.400
144	pressure-side	0.128	0.051	0.400
145	pressure-side	0.130	0.051	0.400
146	pressure-side	0.133	0.050	0.400
147	pressure-side	0.135	0.049	0.400
148	pressure-side	0.137	0.048	0.400
149	pressure-side	0.139	0.047	0.400
150	pressure-side	0.141	0.046	0.400
151	pressure-side	0.143	0.045	0.400
152	pressure-side	0.145	0.044	0.400
153	pressure-side	0.147	0.043	0.400
154	pressure-side	0.149	0.042	0.400
155	pressure-side	0.151	0.040	0.400
156	pressure-side	0.153	0.039	0.400
157	pressure-side	0.155	0.038	0.400
158	pressure-side	0.157	0.037	0.400
159	pressure-side	0.159	0.036	0.400
160	pressure-side	0.161	0.035	0.400
161	pressure-side	0.163	0.033	0.400
162	pressure-side	0.165	0.032	0.400
163	pressure-side	0.166	0.031	0.400
164	pressure-side	0.168	0.029	0.400
165	pressure-side	0.170	0.028	0.400
166	pressure-side	0.172	0.027	0.400
167	pressure-side	0.174	0.025	0.400
168	pressure-side	0.176	0.024	0.400
169	pressure-side	0.177	0.023	0.400
170	pressure-side	0.179	0.021	0.400
171	pressure-side	0.181	0.020	0.400
172	pressure-side	0.183	0.018	0.400
173	pressure-side	0.185	0.017	0.400
174	pressure-side	0.186	0.015	0.400
175	pressure-side	0.188	0.014	0.400
176	pressure-side	0.190	0.012	0.400
177	pressure-side	0.191	0.011	0.400
178	pressure-side	0.193	0.009	0.400
179	pressure-side	0.195	0.008	0.400
180	pressure-side	0.196	0.006	0.400
181	pressure-side	0.198	0.004	0.400
182	pressure-side	0.200	0.003	0.400
183	pressure-side	0.201	0.001	0.400
184	pressure-side	0.203	0.000	0.400
185	pressure-side	0.204	−0.002	0.400
186	pressure-side	0.206	−0.004	0.400
187	pressure-side	0.207	−0.006	0.400
188	pressure-side	0.209	−0.007	0.400
189	pressure-side	0.210	−0.009	0.400
190	pressure-side	0.212	−0.011	0.400
191	pressure-side	0.214	−0.012	0.400
192	pressure-side	0.215	−0.014	0.400
193	pressure-side	0.216	−0.016	0.400
194	pressure-side	0.218	−0.018	0.400
195	pressure-side	0.220	−0.019	0.400
196	pressure-side	0.220	−0.019	0.400
197	pressure-side	0.221	−0.019	0.400
198	pressure-side	0.221	−0.019	0.400
199	pressure-side	0.222	−0.019	0.400
200	pressure-side	0.222	−0.019	0.400
1	suction-side	0.035	0.082	0.500
2	suction-side	0.035	0.084	0.500
3	suction-side	0.037	0.086	0.500
4	suction-side	0.039	0.088	0.500
5	suction-side	0.041	0.089	0.500
6	suction-side	0.043	0.090	0.500
7	suction-side	0.045	0.092	0.500
8	suction-side	0.048	0.093	0.500
9	suction-side	0.050	0.094	0.500
10	suction-side	0.053	0.094	0.500
11	suction-side	0.055	0.095	0.500
12	suction-side	0.057	0.096	0.500
13	suction-side	0.060	0.096	0.500

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
14	suction-side	0.062	0.097	0.500
15	suction-side	0.065	0.097	0.500
16	suction-side	0.067	0.098	0.500
17	suction-side	0.070	0.098	0.500
18	suction-side	0.073	0.098	0.500
19	suction-side	0.075	0.098	0.500
20	suction-side	0.078	0.098	0.500
21	suction-side	0.080	0.098	0.500
22	suction-side	0.083	0.098	0.500
23	suction-side	0.085	0.098	0.500
24	suction-side	0.088	0.097	0.500
25	suction-side	0.090	0.097	0.500
26	suction-side	0.093	0.097	0.500
27	suction-side	0.095	0.096	0.500
28	suction-side	0.098	0.096	0.500
29	suction-side	0.100	0.095	0.500
30	suction-side	0.103	0.094	0.500
31	suction-side	0.105	0.093	0.500
32	suction-side	0.108	0.093	0.500
33	suction-side	0.110	0.092	0.500
34	suction-side	0.112	0.091	0.500
35	suction-side	0.115	0.090	0.500
36	suction-side	0.117	0.089	0.500
37	suction-side	0.119	0.087	0.500
38	suction-side	0.121	0.086	0.500
39	suction-side	0.124	0.085	0.500
40	suction-side	0.126	0.084	0.500
41	suction-side	0.128	0.082	0.500
42	suction-side	0.130	0.081	0.500
43	suction-side	0.132	0.079	0.500
44	suction-side	0.134	0.078	0.500
45	suction-side	0.136	0.076	0.500
46	suction-side	0.138	0.075	0.500
47	suction-side	0.140	0.073	0.500
48	suction-side	0.142	0.071	0.500
49	suction-side	0.144	0.070	0.500
50	suction-side	0.146	0.068	0.500
51	suction-side	0.147	0.066	0.500
52	suction-side	0.149	0.064	0.500
53	suction-side	0.151	0.063	0.500
54	suction-side	0.153	0.061	0.500
55	suction-side	0.154	0.059	0.500
56	suction-side	0.156	0.057	0.500
57	suction-side	0.158	0.055	0.500
58	suction-side	0.160	0.053	0.500
59	suction-side	0.161	0.051	0.500
60	suction-side	0.163	0.049	0.500
61	suction-side	0.164	0.047	0.500
62	suction-side	0.166	0.045	0.500
63	suction-side	0.168	0.043	0.500
64	suction-side	0.169	0.041	0.500
65	suction-side	0.171	0.039	0.500
66	suction-side	0.172	0.037	0.500
67	suction-side	0.174	0.035	0.500
68	suction-side	0.176	0.033	0.500
69	suction-side	0.177	0.031	0.500
70	suction-side	0.179	0.029	0.500
71	suction-side	0.180	0.027	0.500
72	suction-side	0.182	0.025	0.500
73	suction-side	0.183	0.023	0.500
74	suction-side	0.185	0.021	0.500
75	suction-side	0.186	0.019	0.500
76	suction-side	0.188	0.017	0.500
77	suction-side	0.189	0.015	0.500
78	suction-side	0.191	0.013	0.500
79	suction-side	0.193	0.011	0.500
80	suction-side	0.194	0.009	0.500
81	suction-side	0.196	0.007	0.500
82	suction-side	0.197	0.005	0.500
83	suction-side	0.199	0.003	0.500
84	suction-side	0.200	0.001	0.500
85	suction-side	0.202	−0.001	0.500
86	suction-side	0.203	−0.003	0.500
87	suction-side	0.205	−0.005	0.500
88	suction-side	0.206	−0.007	0.500
89	suction-side	0.208	−0.009	0.500

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
90	suction-side	0.209	−0.011	0.500
91	suction-side	0.211	−0.013	0.500
92	suction-side	0.212	−0.015	0.500
93	suction-side	0.214	−0.017	0.500
94	suction-side	0.215	−0.020	0.500
95	suction-side	0.216	−0.024	0.500
96	suction-side	0.216	−0.024	0.500
97	suction-side	0.216	−0.023	0.500
98	suction-side	0.217	−0.022	0.500
99	suction-side	0.217	−0.023	0.500
100	suction-side	0.217	−0.022	0.500
101	pressure-side	0.035	0.082	0.500
102	pressure-side	0.036	0.080	0.500
103	pressure-side	0.039	0.080	0.500
104	pressure-side	0.041	0.080	0.500
105	pressure-side	0.043	0.080	0.500
106	pressure-side	0.046	0.080	0.500
107	pressure-side	0.048	0.080	0.500
108	pressure-side	0.050	0.080	0.500
109	pressure-side	0.053	0.080	0.500
110	pressure-side	0.055	0.080	0.500
111	pressure-side	0.057	0.080	0.500
112	pressure-side	0.060	0.080	0.500
113	pressure-side	0.062	0.080	0.500
114	pressure-side	0.064	0.080	0.500
115	pressure-side	0.067	0.080	0.500
116	pressure-side	0.069	0.079	0.500
117	pressure-side	0.071	0.079	0.500
118	pressure-side	0.074	0.079	0.500
119	pressure-side	0.076	0.079	0.500
120	pressure-side	0.078	0.078	0.500
121	pressure-side	0.081	0.078	0.500
122	pressure-side	0.083	0.077	0.500
123	pressure-side	0.085	0.077	0.500
124	pressure-side	0.087	0.076	0.500
125	pressure-side	0.090	0.076	0.500
126	pressure-side	0.092	0.075	0.500
127	pressure-side	0.094	0.075	0.500
128	pressure-side	0.096	0.074	0.500
129	pressure-side	0.098	0.073	0.500
130	pressure-side	0.100	0.072	0.500
131	pressure-side	0.103	0.072	0.500
132	pressure-side	0.105	0.071	0.500
133	pressure-side	0.107	0.070	0.500
134	pressure-side	0.109	0.069	0.500
135	pressure-side	0.111	0.068	0.500
136	pressure-side	0.113	0.067	0.500
137	pressure-side	0.115	0.066	0.500
138	pressure-side	0.117	0.065	0.500
139	pressure-side	0.119	0.064	0.500
140	pressure-side	0.121	0.062	0.500
141	pressure-side	0.123	0.061	0.500
142	pressure-side	0.125	0.060	0.500
143	pressure-side	0.127	0.059	0.500
144	pressure-side	0.129	0.057	0.500
145	pressure-side	0.131	0.056	0.500
146	pressure-side	0.133	0.055	0.500
147	pressure-side	0.135	0.053	0.500
148	pressure-side	0.137	0.052	0.500
149	pressure-side	0.138	0.051	0.500
150	pressure-side	0.140	0.049	0.500
151	pressure-side	0.142	0.048	0.500
152	pressure-side	0.144	0.046	0.500
153	pressure-side	0.146	0.045	0.500
154	pressure-side	0.147	0.043	0.500
155	pressure-side	0.149	0.042	0.500
156	pressure-side	0.151	0.040	0.500
157	pressure-side	0.153	0.039	0.500
158	pressure-side	0.154	0.037	0.500
159	pressure-side	0.156	0.036	0.500
160	pressure-side	0.158	0.034	0.500
161	pressure-side	0.159	0.032	0.500
162	pressure-side	0.161	0.031	0.500
163	pressure-side	0.163	0.029	0.500
164	pressure-side	0.164	0.028	0.500
165	pressure-side	0.166	0.026	0.500

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
166	pressure-side	0.168	0.024	0.500
167	pressure-side	0.169	0.023	0.500
168	pressure-side	0.171	0.021	0.500
169	pressure-side	0.173	0.020	0.500
170	pressure-side	0.174	0.018	0.500
171	pressure-side	0.176	0.016	0.500
172	pressure-side	0.177	0.015	0.500
173	pressure-side	0.179	0.013	0.500
174	pressure-side	0.181	0.011	0.500
175	pressure-side	0.182	0.010	0.500
176	pressure-side	0.184	0.008	0.500
177	pressure-side	0.186	0.006	0.500
178	pressure-side	0.187	0.005	0.500
179	pressure-side	0.189	0.003	0.500
180	pressure-side	0.190	0.001	0.500
181	pressure-side	0.192	0.000	0.500
182	pressure-side	0.194	−0.002	0.500
183	pressure-side	0.195	−0.004	0.500
184	pressure-side	0.197	−0.005	0.500
185	pressure-side	0.198	−0.007	0.500
186	pressure-side	0.200	−0.009	0.500
187	pressure-side	0.201	−0.010	0.500
188	pressure-side	0.203	−0.012	0.500
189	pressure-side	0.204	−0.014	0.500
190	pressure-side	0.206	−0.016	0.500
191	pressure-side	0.207	−0.017	0.500
192	pressure-side	0.209	−0.019	0.500
193	pressure-side	0.210	−0.021	0.500
194	pressure-side	0.212	−0.023	0.500
195	pressure-side	0.214	−0.024	0.500
196	pressure-side	0.214	−0.024	0.500
197	pressure-side	0.215	−0.024	0.500
198	pressure-side	0.215	−0.024	0.500
199	pressure-side	0.216	−0.024	0.500
200	pressure-side	0.216	−0.024	0.500
1	suction-side	0.037	0.100	0.600
2	suction-side	0.039	0.102	0.600
3	suction-side	0.040	0.104	0.600
4	suction-side	0.043	0.105	0.600
5	suction-side	0.045	0.106	0.600
6	suction-side	0.047	0.107	0.600
7	suction-side	0.050	0.108	0.600
8	suction-side	0.052	0.108	0.600
9	suction-side	0.055	0.109	0.600
10	suction-side	0.057	0.109	0.600
11	suction-side	0.060	0.109	0.600
12	suction-side	0.062	0.109	0.600
13	suction-side	0.065	0.109	0.600
14	suction-side	0.068	0.109	0.600
15	suction-side	0.070	0.109	0.600
16	suction-side	0.073	0.109	0.600
17	suction-side	0.075	0.109	0.600
18	suction-side	0.078	0.108	0.600
19	suction-side	0.080	0.108	0.600
20	suction-side	0.083	0.107	0.600
21	suction-side	0.085	0.107	0.600
22	suction-side	0.087	0.106	0.600
23	suction-side	0.090	0.105	0.600
24	suction-side	0.092	0.104	0.600
25	suction-side	0.095	0.104	0.600
26	suction-side	0.097	0.103	0.600
27	suction-side	0.099	0.101	0.600
28	suction-side	0.102	0.100	0.600
29	suction-side	0.104	0.099	0.600
30	suction-side	0.106	0.098	0.600
31	suction-side	0.108	0.097	0.600
32	suction-side	0.110	0.095	0.600
33	suction-side	0.112	0.094	0.600
34	suction-side	0.115	0.092	0.600
35	suction-side	0.117	0.091	0.600
36	suction-side	0.119	0.089	0.600
37	suction-side	0.121	0.088	0.600
38	suction-side	0.122	0.086	0.600
39	suction-side	0.124	0.085	0.600
40	suction-side	0.126	0.083	0.600
41	suction-side	0.128	0.081	0.600

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
42	suction-side	0.130	0.079	0.600
43	suction-side	0.132	0.078	0.600
44	suction-side	0.133	0.076	0.600
45	suction-side	0.135	0.074	0.600
46	suction-side	0.137	0.072	0.600
47	suction-side	0.139	0.070	0.600
48	suction-side	0.140	0.069	0.600
49	suction-side	0.142	0.067	0.600
50	suction-side	0.144	0.065	0.600
51	suction-side	0.145	0.063	0.600
52	suction-side	0.147	0.061	0.600
53	suction-side	0.148	0.059	0.600
54	suction-side	0.150	0.057	0.600
55	suction-side	0.152	0.055	0.600
56	suction-side	0.153	0.053	0.600
57	suction-side	0.155	0.051	0.600
58	suction-side	0.156	0.049	0.600
59	suction-side	0.158	0.047	0.600
60	suction-side	0.159	0.045	0.600
61	suction-side	0.161	0.043	0.600
62	suction-side	0.163	0.041	0.600
63	suction-side	0.164	0.039	0.600
64	suction-side	0.166	0.037	0.600
65	suction-side	0.167	0.035	0.600
66	suction-side	0.169	0.033	0.600
67	suction-side	0.170	0.031	0.600
68	suction-side	0.172	0.029	0.600
69	suction-side	0.173	0.027	0.600
70	suction-side	0.175	0.025	0.600
71	suction-side	0.176	0.023	0.600
72	suction-side	0.178	0.021	0.600
73	suction-side	0.179	0.019	0.600
74	suction-side	0.181	0.017	0.600
75	suction-side	0.182	0.015	0.600
76	suction-side	0.184	0.013	0.600
77	suction-side	0.185	0.011	0.600
78	suction-side	0.187	0.009	0.600
79	suction-side	0.188	0.007	0.600
80	suction-side	0.190	0.005	0.600
81	suction-side	0.191	0.003	0.600
82	suction-side	0.193	0.001	0.600
83	suction-side	0.194	−0.001	0.600
84	suction-side	0.196	−0.003	0.600
85	suction-side	0.197	−0.005	0.600
86	suction-side	0.198	−0.007	0.600
87	suction-side	0.200	−0.009	0.600
88	suction-side	0.201	−0.011	0.600
89	suction-side	0.203	−0.013	0.600
90	suction-side	0.204	−0.015	0.600
91	suction-side	0.206	−0.018	0.600
92	suction-side	0.207	−0.020	0.600
93	suction-side	0.209	−0.022	0.600
94	suction-side	0.210	−0.024	0.600
95	suction-side	0.211	−0.028	0.600
96	suction-side	0.211	−0.028	0.600
97	suction-side	0.211	−0.027	0.600
98	suction-side	0.211	−0.026	0.600
99	suction-side	0.211	−0.027	0.600
100	suction-side	0.211	−0.026	0.600
101	pressure-side	0.037	0.100	0.600
102	pressure-side	0.039	0.098	0.600
103	pressure-side	0.041	0.098	0.600
104	pressure-side	0.044	0.097	0.600
105	pressure-side	0.046	0.097	0.600
106	pressure-side	0.049	0.097	0.600
107	pressure-side	0.051	0.097	0.600
108	pressure-side	0.054	0.097	0.600
109	pressure-side	0.056	0.096	0.600
110	pressure-side	0.058	0.096	0.600
111	pressure-side	0.061	0.096	0.600
112	pressure-side	0.063	0.096	0.600
113	pressure-side	0.066	0.095	0.600
114	pressure-side	0.068	0.095	0.600
115	pressure-side	0.070	0.095	0.600
116	pressure-side	0.073	0.094	0.600
117	pressure-side	0.075	0.094	0.600

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
118	pressure-side	0.077	0.093	0.600
119	pressure-side	0.080	0.092	0.600
120	pressure-side	0.082	0.092	0.600
121	pressure-side	0.084	0.091	0.600
122	pressure-side	0.087	0.090	0.600
123	pressure-side	0.089	0.089	0.600
124	pressure-side	0.091	0.088	0.600
125	pressure-side	0.093	0.087	0.600
126	pressure-side	0.095	0.087	0.600
127	pressure-side	0.098	0.085	0.600
128	pressure-side	0.100	0.084	0.600
129	pressure-side	0.102	0.083	0.600
130	pressure-side	0.104	0.082	0.600
131	pressure-side	0.106	0.081	0.600
132	pressure-side	0.108	0.080	0.600
133	pressure-side	0.110	0.078	0.600
134	pressure-side	0.112	0.077	0.600
135	pressure-side	0.114	0.076	0.600
136	pressure-side	0.116	0.074	0.600
137	pressure-side	0.118	0.073	0.600
138	pressure-side	0.120	0.071	0.600
139	pressure-side	0.121	0.070	0.600
140	pressure-side	0.123	0.068	0.600
141	pressure-side	0.125	0.067	0.600
142	pressure-side	0.127	0.065	0.600
143	pressure-side	0.129	0.064	0.600
144	pressure-side	0.130	0.062	0.600
145	pressure-side	0.132	0.060	0.600
146	pressure-side	0.134	0.059	0.600
147	pressure-side	0.135	0.057	0.600
148	pressure-side	0.137	0.055	0.600
149	pressure-side	0.138	0.054	0.600
150	pressure-side	0.140	0.052	0.600
151	pressure-side	0.142	0.050	0.600
152	pressure-side	0.143	0.049	0.600
153	pressure-side	0.145	0.047	0.600
154	pressure-side	0.146	0.045	0.600
155	pressure-side	0.148	0.043	0.600
156	pressure-side	0.149	0.041	0.600
157	pressure-side	0.151	0.040	0.600
158	pressure-side	0.152	0.038	0.600
159	pressure-side	0.154	0.036	0.600
160	pressure-side	0.155	0.034	0.600
161	pressure-side	0.157	0.032	0.600
162	pressure-side	0.158	0.031	0.600
163	pressure-side	0.160	0.029	0.600
164	pressure-side	0.161	0.027	0.600
165	pressure-side	0.163	0.025	0.600
166	pressure-side	0.164	0.023	0.600
167	pressure-side	0.166	0.021	0.600
168	pressure-side	0.167	0.020	0.600
169	pressure-side	0.169	0.018	0.600
170	pressure-side	0.170	0.016	0.600
171	pressure-side	0.172	0.014	0.600
172	pressure-side	0.173	0.012	0.600
173	pressure-side	0.175	0.011	0.600
174	pressure-side	0.176	0.009	0.600
175	pressure-side	0.178	0.007	0.600
176	pressure-side	0.179	0.005	0.600
177	pressure-side	0.181	0.004	0.600
178	pressure-side	0.182	0.002	0.600
179	pressure-side	0.184	0.000	0.600
180	pressure-side	0.185	−0.002	0.600
181	pressure-side	0.187	−0.004	0.600
182	pressure-side	0.188	−0.005	0.600
183	pressure-side	0.190	−0.007	0.600
184	pressure-side	0.192	−0.009	0.600
185	pressure-side	0.193	−0.011	0.600
186	pressure-side	0.195	−0.012	0.600
187	pressure-side	0.196	−0.014	0.600
188	pressure-side	0.198	−0.016	0.600
189	pressure-side	0.199	−0.018	0.600
190	pressure-side	0.201	−0.020	0.600
191	pressure-side	0.202	−0.021	0.600
192	pressure-side	0.204	−0.023	0.600
193	pressure-side	0.205	−0.025	0.600

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
194	pressure-side	0.207	−0.027	0.600
195	pressure-side	0.208	−0.028	0.600
196	pressure-side	0.209	−0.029	0.600
197	pressure-side	0.209	−0.029	0.600
198	pressure-side	0.210	−0.028	0.600
199	pressure-side	0.211	−0.028	0.600
200	pressure-side	0.211	−0.028	0.600
1	suction-side	0.043	0.119	0.700
2	suction-side	0.045	0.121	0.700
3	suction-side	0.047	0.122	0.700
4	suction-side	0.049	0.122	0.700
5	suction-side	0.052	0.123	0.700
6	suction-side	0.054	0.123	0.700
7	suction-side	0.057	0.123	0.700
8	suction-side	0.059	0.123	0.700
9	suction-side	0.062	0.123	0.700
10	suction-side	0.064	0.122	0.700
11	suction-side	0.067	0.122	0.700
12	suction-side	0.069	0.121	0.700
13	suction-side	0.072	0.121	0.700
14	suction-side	0.074	0.120	0.700
15	suction-side	0.076	0.119	0.700
16	suction-side	0.079	0.118	0.700
17	suction-side	0.081	0.117	0.700
18	suction-side	0.083	0.116	0.700
19	suction-side	0.086	0.115	0.700
20	suction-side	0.088	0.114	0.700
21	suction-side	0.090	0.113	0.700
22	suction-side	0.092	0.112	0.700
23	suction-side	0.094	0.110	0.700
24	suction-side	0.096	0.109	0.700
25	suction-side	0.098	0.108	0.700
26	suction-side	0.100	0.106	0.700
27	suction-side	0.102	0.105	0.700
28	suction-side	0.104	0.103	0.700
29	suction-side	0.106	0.102	0.700
30	suction-side	0.108	0.100	0.700
31	suction-side	0.110	0.098	0.700
32	suction-side	0.112	0.097	0.700
33	suction-side	0.114	0.095	0.700
34	suction-side	0.115	0.093	0.700
35	suction-side	0.117	0.092	0.700
36	suction-side	0.119	0.090	0.700
37	suction-side	0.121	0.088	0.700
38	suction-side	0.122	0.086	0.700
39	suction-side	0.124	0.084	0.700
40	suction-side	0.126	0.083	0.700
41	suction-side	0.127	0.081	0.700
42	suction-side	0.129	0.079	0.700
43	suction-side	0.131	0.077	0.700
44	suction-side	0.132	0.075	0.700
45	suction-side	0.134	0.073	0.700
46	suction-side	0.135	0.071	0.700
47	suction-side	0.137	0.069	0.700
48	suction-side	0.139	0.068	0.700
49	suction-side	0.140	0.066	0.700
50	suction-side	0.142	0.064	0.700
51	suction-side	0.143	0.062	0.700
52	suction-side	0.145	0.060	0.700
53	suction-side	0.146	0.058	0.700
54	suction-side	0.148	0.056	0.700
55	suction-side	0.149	0.054	0.700
56	suction-side	0.151	0.052	0.700
57	suction-side	0.152	0.050	0.700
58	suction-side	0.154	0.048	0.700
59	suction-side	0.155	0.046	0.700
60	suction-side	0.157	0.044	0.700
61	suction-side	0.158	0.042	0.700
62	suction-side	0.160	0.040	0.700
63	suction-side	0.161	0.038	0.700
64	suction-side	0.163	0.036	0.700
65	suction-side	0.164	0.034	0.700
66	suction-side	0.166	0.032	0.700
67	suction-side	0.167	0.030	0.700
68	suction-side	0.169	0.028	0.700
69	suction-side	0.170	0.026	0.700

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
70	suction-side	0.171	0.024	0.700
71	suction-side	0.173	0.022	0.700
72	suction-side	0.174	0.020	0.700
73	suction-side	0.176	0.018	0.700
74	suction-side	0.177	0.016	0.700
75	suction-side	0.179	0.014	0.700
76	suction-side	0.180	0.012	0.700
77	suction-side	0.182	0.010	0.700
78	suction-side	0.183	0.008	0.700
79	suction-side	0.184	0.006	0.700
80	suction-side	0.186	0.004	0.700
81	suction-side	0.187	0.002	0.700
82	suction-side	0.189	0.000	0.700
83	suction-side	0.190	−0.002	0.700
84	suction-side	0.191	−0.004	0.700
85	suction-side	0.193	−0.006	0.700
86	suction-side	0.194	−0.009	0.700
87	suction-side	0.196	−0.011	0.700
88	suction-side	0.197	−0.013	0.700
89	suction-side	0.198	−0.015	0.700
90	suction-side	0.200	−0.017	0.700
91	suction-side	0.201	−0.019	0.700
92	suction-side	0.203	−0.021	0.700
93	suction-side	0.204	−0.023	0.700
94	suction-side	0.205	−0.025	0.700
95	suction-side	0.206	−0.029	0.700
96	suction-side	0.206	−0.029	0.700
97	suction-side	0.206	−0.029	0.700
98	suction-side	0.207	−0.027	0.700
99	suction-side	0.207	−0.028	0.700
100	suction-side	0.207	−0.028	0.700
101	pressure-side	0.043	0.119	0.700
102	pressure-side	0.044	0.117	0.700
103	pressure-side	0.047	0.116	0.700
104	pressure-side	0.049	0.115	0.700
105	pressure-side	0.051	0.115	0.700
106	pressure-side	0.054	0.114	0.700
107	pressure-side	0.056	0.114	0.700
108	pressure-side	0.058	0.113	0.700
109	pressure-side	0.061	0.113	0.700
110	pressure-side	0.063	0.112	0.700
111	pressure-side	0.065	0.111	0.700
112	pressure-side	0.067	0.111	0.700
113	pressure-side	0.070	0.110	0.700
114	pressure-side	0.072	0.109	0.700
115	pressure-side	0.074	0.108	0.700
116	pressure-side	0.076	0.107	0.700
117	pressure-side	0.078	0.106	0.700
118	pressure-side	0.081	0.105	0.700
119	pressure-side	0.083	0.103	0.700
120	pressure-side	0.085	0.102	0.700
121	pressure-side	0.087	0.101	0.700
122	pressure-side	0.089	0.100	0.700
123	pressure-side	0.091	0.098	0.700
124	pressure-side	0.093	0.097	0.700
125	pressure-side	0.095	0.096	0.700
126	pressure-side	0.097	0.094	0.700
127	pressure-side	0.099	0.093	0.700
128	pressure-side	0.100	0.092	0.700
129	pressure-side	0.102	0.090	0.700
130	pressure-side	0.104	0.089	0.700
131	pressure-side	0.106	0.087	0.700
132	pressure-side	0.108	0.086	0.700
133	pressure-side	0.110	0.084	0.700
134	pressure-side	0.111	0.082	0.700
135	pressure-side	0.113	0.081	0.700
136	pressure-side	0.115	0.079	0.700
137	pressure-side	0.117	0.078	0.700
138	pressure-side	0.118	0.076	0.700
139	pressure-side	0.120	0.074	0.700
140	pressure-side	0.122	0.073	0.700
141	pressure-side	0.123	0.071	0.700
142	pressure-side	0.125	0.069	0.700
143	pressure-side	0.127	0.067	0.700
144	pressure-side	0.128	0.066	0.700
145	pressure-side	0.130	0.064	0.700

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
146	pressure-side	0.132	0.062	0.700
147	pressure-side	0.133	0.060	0.700
148	pressure-side	0.135	0.059	0.700
149	pressure-side	0.136	0.057	0.700
150	pressure-side	0.138	0.055	0.700
151	pressure-side	0.139	0.053	0.700
152	pressure-side	0.141	0.051	0.700
153	pressure-side	0.142	0.050	0.700
154	pressure-side	0.144	0.048	0.700
155	pressure-side	0.145	0.046	0.700
156	pressure-side	0.147	0.044	0.700
157	pressure-side	0.148	0.042	0.700
158	pressure-side	0.150	0.040	0.700
159	pressure-side	0.151	0.039	0.700
160	pressure-side	0.153	0.037	0.700
161	pressure-side	0.154	0.035	0.700
162	pressure-side	0.156	0.033	0.700
163	pressure-side	0.157	0.031	0.700
164	pressure-side	0.159	0.029	0.700
165	pressure-side	0.160	0.027	0.700
166	pressure-side	0.162	0.025	0.700
167	pressure-side	0.163	0.023	0.700
168	pressure-side	0.164	0.022	0.700
169	pressure-side	0.166	0.020	0.700
170	pressure-side	0.167	0.018	0.700
171	pressure-side	0.169	0.016	0.700
172	pressure-side	0.170	0.014	0.700
173	pressure-side	0.172	0.012	0.700
174	pressure-side	0.173	0.010	0.700
175	pressure-side	0.175	0.008	0.700
176	pressure-side	0.176	0.006	0.700
177	pressure-side	0.177	0.004	0.700
178	pressure-side	0.179	0.003	0.700
179	pressure-side	0.180	0.001	0.700
180	pressure-side	0.182	−0.001	0.700
181	pressure-side	0.183	−0.003	0.700
182	pressure-side	0.185	−0.005	0.700
183	pressure-side	0.186	−0.007	0.700
184	pressure-side	0.187	−0.009	0.700
185	pressure-side	0.189	−0.011	0.700
186	pressure-side	0.190	−0.013	0.700
187	pressure-side	0.192	−0.015	0.700
188	pressure-side	0.193	−0.016	0.700
189	pressure-side	0.195	−0.018	0.700
190	pressure-side	0.196	−0.020	0.700
191	pressure-side	0.198	−0.022	0.700
192	pressure-side	0.199	−0.024	0.700
193	pressure-side	0.200	−0.026	0.700
194	pressure-side	0.202	−0.028	0.700
195	pressure-side	0.203	−0.030	0.700
196	pressure-side	0.204	−0.030	0.700
197	pressure-side	0.205	−0.030	0.700
198	pressure-side	0.205	−0.030	0.700
199	pressure-side	0.206	−0.029	0.700
200	pressure-side	0.206	−0.029	0.700
1	suction-side	0.051	0.134	0.800
2	suction-side	0.053	0.135	0.800
3	suction-side	0.055	0.136	0.800
4	suction-side	0.058	0.136	0.800
5	suction-side	0.060	0.136	0.800
6	suction-side	0.062	0.136	0.800
7	suction-side	0.065	0.135	0.800
8	suction-side	0.067	0.135	0.800
9	suction-side	0.069	0.134	0.800
10	suction-side	0.072	0.133	0.800
11	suction-side	0.074	0.132	0.800
12	suction-side	0.076	0.131	0.800
13	suction-side	0.078	0.130	0.800
14	suction-side	0.080	0.129	0.800
15	suction-side	0.083	0.128	0.800
16	suction-side	0.085	0.127	0.800
17	suction-side	0.087	0.126	0.800
18	suction-side	0.089	0.124	0.800
19	suction-side	0.091	0.123	0.800
20	suction-side	0.093	0.121	0.800
21	suction-side	0.094	0.120	0.800

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
22	suction-side	0.096	0.118	0.800
23	suction-side	0.098	0.117	0.800
24	suction-side	0.100	0.115	0.800
25	suction-side	0.102	0.114	0.800
26	suction-side	0.103	0.112	0.800
27	suction-side	0.105	0.110	0.800
28	suction-side	0.107	0.109	0.800
29	suction-side	0.108	0.107	0.800
30	suction-side	0.110	0.105	0.800
31	suction-side	0.111	0.103	0.800
32	suction-side	0.113	0.101	0.800
33	suction-side	0.114	0.100	0.800
34	suction-side	0.116	0.098	0.800
35	suction-side	0.118	0.096	0.800
36	suction-side	0.119	0.094	0.800
37	suction-side	0.121	0.092	0.800
38	suction-side	0.122	0.090	0.800
39	suction-side	0.123	0.088	0.800
40	suction-side	0.125	0.086	0.800
41	suction-side	0.126	0.085	0.800
42	suction-side	0.128	0.083	0.800
43	suction-side	0.129	0.081	0.800
44	suction-side	0.131	0.079	0.800
45	suction-side	0.132	0.077	0.800
46	suction-side	0.134	0.075	0.800
47	suction-side	0.135	0.073	0.800
48	suction-side	0.136	0.071	0.800
49	suction-side	0.138	0.069	0.800
50	suction-side	0.139	0.067	0.800
51	suction-side	0.141	0.065	0.800
52	suction-side	0.142	0.063	0.800
53	suction-side	0.143	0.061	0.800
54	suction-side	0.145	0.059	0.800
55	suction-side	0.146	0.058	0.800
56	suction-side	0.148	0.056	0.800
57	suction-side	0.149	0.054	0.800
58	suction-side	0.150	0.052	0.800
59	suction-side	0.152	0.050	0.800
60	suction-side	0.153	0.048	0.800
61	suction-side	0.155	0.046	0.800
62	suction-side	0.156	0.044	0.800
63	suction-side	0.157	0.042	0.800
64	suction-side	0.159	0.040	0.800
65	suction-side	0.160	0.038	0.800
66	suction-side	0.161	0.036	0.800
67	suction-side	0.163	0.034	0.800
68	suction-side	0.164	0.032	0.800
69	suction-side	0.166	0.030	0.800
70	suction-side	0.167	0.028	0.800
71	suction-side	0.168	0.026	0.800
72	suction-side	0.170	0.024	0.800
73	suction-side	0.171	0.022	0.800
74	suction-side	0.172	0.020	0.800
75	suction-side	0.174	0.018	0.800
76	suction-side	0.175	0.016	0.800
77	suction-side	0.176	0.014	0.800
78	suction-side	0.178	0.012	0.800
79	suction-side	0.179	0.010	0.800
80	suction-side	0.180	0.008	0.800
81	suction-side	0.182	0.006	0.800
82	suction-side	0.183	0.004	0.800
83	suction-side	0.184	0.002	0.800
84	suction-side	0.186	0.000	0.800
85	suction-side	0.187	−0.002	0.800
86	suction-side	0.188	−0.004	0.800
87	suction-side	0.190	−0.006	0.800
88	suction-side	0.191	−0.008	0.800
89	suction-side	0.192	−0.010	0.800
90	suction-side	0.194	−0.012	0.800
91	suction-side	0.195	−0.014	0.800
92	suction-side	0.196	−0.016	0.800
93	suction-side	0.197	−0.018	0.800
94	suction-side	0.199	−0.020	0.800
95	suction-side	0.199	−0.024	0.800
96	suction-side	0.199	−0.024	0.800
97	suction-side	0.200	−0.023	0.800

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
98	suction-side	0.200	−0.023	0.800
99	suction-side	0.200	−0.022	0.800
100	suction-side	0.200	−0.022	0.800
101	pressure-side	0.051	0.134	0.800
102	pressure-side	0.052	0.132	0.800
103	pressure-side	0.054	0.131	0.800
104	pressure-side	0.056	0.130	0.800
105	pressure-side	0.059	0.130	0.800
106	pressure-side	0.061	0.129	0.800
107	pressure-side	0.063	0.128	0.800
108	pressure-side	0.065	0.127	0.800
109	pressure-side	0.068	0.127	0.800
110	pressure-side	0.070	0.126	0.800
111	pressure-side	0.072	0.125	0.800
112	pressure-side	0.074	0.124	0.800
113	pressure-side	0.076	0.122	0.800
114	pressure-side	0.078	0.121	0.800
115	pressure-side	0.080	0.120	0.800
116	pressure-side	0.082	0.119	0.800
117	pressure-side	0.084	0.117	0.800
118	pressure-side	0.086	0.116	0.800
119	pressure-side	0.087	0.114	0.800
120	pressure-side	0.089	0.113	0.800
121	pressure-side	0.091	0.111	0.800
122	pressure-side	0.093	0.110	0.800
123	pressure-side	0.094	0.108	0.800
124	pressure-side	0.096	0.107	0.800
125	pressure-side	0.098	0.105	0.800
126	pressure-side	0.099	0.103	0.800
127	pressure-side	0.101	0.102	0.800
128	pressure-side	0.103	0.100	0.800
129	pressure-side	0.104	0.098	0.800
130	pressure-side	0.106	0.097	0.800
131	pressure-side	0.107	0.095	0.800
132	pressure-side	0.109	0.093	0.800
133	pressure-side	0.111	0.092	0.800
134	pressure-side	0.112	0.090	0.800
135	pressure-side	0.114	0.088	0.800
136	pressure-side	0.115	0.086	0.800
137	pressure-side	0.117	0.085	0.800
138	pressure-side	0.118	0.083	0.800
139	pressure-side	0.120	0.081	0.800
140	pressure-side	0.121	0.079	0.800
141	pressure-side	0.123	0.077	0.800
142	pressure-side	0.124	0.076	0.800
143	pressure-side	0.126	0.074	0.800
144	pressure-side	0.127	0.072	0.800
145	pressure-side	0.129	0.070	0.800
146	pressure-side	0.130	0.068	0.800
147	pressure-side	0.131	0.067	0.800
148	pressure-side	0.133	0.065	0.800
149	pressure-side	0.134	0.063	0.800
150	pressure-side	0.136	0.061	0.800
151	pressure-side	0.137	0.059	0.800
152	pressure-side	0.139	0.057	0.800
153	pressure-side	0.140	0.056	0.800
154	pressure-side	0.142	0.054	0.800
155	pressure-side	0.143	0.052	0.800
156	pressure-side	0.144	0.050	0.800
157	pressure-side	0.146	0.048	0.800
158	pressure-side	0.147	0.046	0.800
159	pressure-side	0.149	0.044	0.800
160	pressure-side	0.150	0.043	0.800
161	pressure-side	0.151	0.041	0.800
162	pressure-side	0.153	0.039	0.800
163	pressure-side	0.154	0.037	0.800
164	pressure-side	0.155	0.035	0.800
165	pressure-side	0.157	0.033	0.800
166	pressure-side	0.158	0.031	0.800
167	pressure-side	0.159	0.029	0.800
168	pressure-side	0.161	0.027	0.800
169	pressure-side	0.162	0.025	0.800
170	pressure-side	0.163	0.024	0.800
171	pressure-side	0.165	0.022	0.800
172	pressure-side	0.166	0.020	0.800
173	pressure-side	0.167	0.018	0.800

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
174	pressure-side	0.169	0.016	0.800
175	pressure-side	0.170	0.014	0.800
176	pressure-side	0.171	0.012	0.800
177	pressure-side	0.173	0.010	0.800
178	pressure-side	0.174	0.008	0.800
179	pressure-side	0.175	0.006	0.800
180	pressure-side	0.177	0.004	0.800
181	pressure-side	0.178	0.002	0.800
182	pressure-side	0.179	0.000	0.800
183	pressure-side	0.180	−0.001	0.800
184	pressure-side	0.182	−0.003	0.800
185	pressure-side	0.183	−0.005	0.800
186	pressure-side	0.184	−0.007	0.800
187	pressure-side	0.186	−0.009	0.800
188	pressure-side	0.187	−0.011	0.800
189	pressure-side	0.188	−0.013	0.800
190	pressure-side	0.190	−0.015	0.800
191	pressure-side	0.191	−0.017	0.800
192	pressure-side	0.192	−0.019	0.800
193	pressure-side	0.194	−0.021	0.800
194	pressure-side	0.195	−0.023	0.800
195	pressure-side	0.197	−0.024	0.800
196	pressure-side	0.197	−0.024	0.800
197	pressure-side	0.198	−0.024	0.800
198	pressure-side	0.198	−0.024	0.800
199	pressure-side	0.199	−0.024	0.800
200	pressure-side	0.199	−0.024	0.800
1	suction-side	0.062	0.144	0.900
2	suction-side	0.064	0.145	0.900
3	suction-side	0.066	0.146	0.900
4	suction-side	0.068	0.146	0.900
5	suction-side	0.070	0.145	0.900
6	suction-side	0.073	0.145	0.900
7	suction-side	0.075	0.144	0.900
8	suction-side	0.077	0.143	0.900
9	suction-side	0.079	0.142	0.900
10	suction-side	0.081	0.141	0.900
11	suction-side	0.082	0.140	0.900
12	suction-side	0.084	0.139	0.900
13	suction-side	0.086	0.138	0.900
14	suction-side	0.088	0.137	0.900
15	suction-side	0.090	0.136	0.900
16	suction-side	0.091	0.134	0.900
17	suction-side	0.093	0.133	0.900
18	suction-side	0.095	0.132	0.900
19	suction-side	0.096	0.130	0.900
20	suction-side	0.098	0.129	0.900
21	suction-side	0.100	0.127	0.900
22	suction-side	0.101	0.126	0.900
23	suction-side	0.103	0.124	0.900
24	suction-side	0.104	0.122	0.900
25	suction-side	0.105	0.121	0.900
26	suction-side	0.107	0.119	0.900
27	suction-side	0.108	0.117	0.900
28	suction-side	0.110	0.116	0.900
29	suction-side	0.111	0.114	0.900
30	suction-side	0.112	0.112	0.900
31	suction-side	0.114	0.111	0.900
32	suction-side	0.115	0.109	0.900
33	suction-side	0.116	0.107	0.900
34	suction-side	0.118	0.105	0.900
35	suction-side	0.119	0.104	0.900
36	suction-side	0.120	0.102	0.900
37	suction-side	0.121	0.100	0.900
38	suction-side	0.122	0.098	0.900
39	suction-side	0.124	0.096	0.900
40	suction-side	0.125	0.095	0.900
41	suction-side	0.126	0.093	0.900
42	suction-side	0.127	0.091	0.900
43	suction-side	0.128	0.089	0.900
44	suction-side	0.130	0.087	0.900
45	suction-side	0.131	0.086	0.900
46	suction-side	0.132	0.084	0.900
47	suction-side	0.133	0.082	0.900
48	suction-side	0.134	0.080	0.900
49	suction-side	0.136	0.078	0.900

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
50	suction-side	0.137	0.076	0.900
51	suction-side	0.138	0.075	0.900
52	suction-side	0.139	0.073	0.900
53	suction-side	0.140	0.071	0.900
54	suction-side	0.141	0.069	0.900
55	suction-side	0.143	0.067	0.900
56	suction-side	0.144	0.065	0.900
57	suction-side	0.145	0.064	0.900
58	suction-side	0.146	0.062	0.900
59	suction-side	0.147	0.060	0.900
60	suction-side	0.148	0.058	0.900
61	suction-side	0.150	0.056	0.900
62	suction-side	0.151	0.054	0.900
63	suction-side	0.152	0.053	0.900
64	suction-side	0.153	0.051	0.900
65	suction-side	0.154	0.049	0.900
66	suction-side	0.155	0.047	0.900
67	suction-side	0.157	0.045	0.900
68	suction-side	0.158	0.043	0.900
69	suction-side	0.159	0.042	0.900
70	suction-side	0.160	0.040	0.900
71	suction-side	0.161	0.038	0.900
72	suction-side	0.162	0.036	0.900
73	suction-side	0.164	0.034	0.900
74	suction-side	0.165	0.032	0.900
75	suction-side	0.166	0.031	0.900
76	suction-side	0.167	0.029	0.900
77	suction-side	0.168	0.027	0.900
78	suction-side	0.169	0.025	0.900
79	suction-side	0.171	0.023	0.900
80	suction-side	0.172	0.021	0.900
81	suction-side	0.173	0.020	0.900
82	suction-side	0.174	0.018	0.900
83	suction-side	0.175	0.016	0.900
84	suction-side	0.176	0.014	0.900
85	suction-side	0.178	0.012	0.900
86	suction-side	0.179	0.010	0.900
87	suction-side	0.180	0.009	0.900
88	suction-side	0.181	0.007	0.900
89	suction-side	0.182	0.005	0.900
90	suction-side	0.183	0.003	0.900
91	suction-side	0.185	0.001	0.900
92	suction-side	0.186	−0.001	0.900
93	suction-side	0.187	−0.002	0.900
94	suction-side	0.188	−0.008	0.900
95	suction-side	0.188	−0.004	0.900
96	suction-side	0.189	−0.008	0.900
97	suction-side	0.189	−0.007	0.900
98	suction-side	0.189	−0.007	0.900
99	suction-side	0.189	−0.006	0.900
100	suction-side	0.189	−0.006	0.900
101	pressure-side	0.062	0.144	0.900
102	pressure-side	0.063	0.142	0.900
103	pressure-side	0.065	0.141	0.900
104	pressure-side	0.067	0.140	0.900
105	pressure-side	0.069	0.140	0.900
106	pressure-side	0.071	0.139	0.900
107	pressure-side	0.073	0.139	0.900
108	pressure-side	0.075	0.138	0.900
109	pressure-side	0.077	0.137	0.900
110	pressure-side	0.079	0.136	0.900
111	pressure-side	0.081	0.135	0.900
112	pressure-side	0.083	0.134	0.900
113	pressure-side	0.084	0.133	0.900
114	pressure-side	0.086	0.131	0.900
115	pressure-side	0.088	0.130	0.900
116	pressure-side	0.089	0.129	0.900
117	pressure-side	0.091	0.127	0.900
118	pressure-side	0.093	0.126	0.900
119	pressure-side	0.094	0.124	0.900
120	pressure-side	0.096	0.123	0.900
121	pressure-side	0.097	0.121	0.900
122	pressure-side	0.098	0.120	0.900
123	pressure-side	0.100	0.118	0.900
124	pressure-side	0.101	0.116	0.900
125	pressure-side	0.103	0.115	0.900

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
126	pressure-side	0.104	0.113	0.900
127	pressure-side	0.105	0.112	0.900
128	pressure-side	0.107	0.110	0.900
129	pressure-side	0.108	0.108	0.900
130	pressure-side	0.109	0.107	0.900
131	pressure-side	0.111	0.105	0.900
132	pressure-side	0.112	0.103	0.900
133	pressure-side	0.113	0.101	0.900
134	pressure-side	0.114	0.100	0.900
135	pressure-side	0.116	0.098	0.900
136	pressure-side	0.117	0.096	0.900
137	pressure-side	0.118	0.095	0.900
138	pressure-side	0.119	0.093	0.900
139	pressure-side	0.121	0.091	0.900
140	pressure-side	0.122	0.089	0.900
141	pressure-side	0.123	0.088	0.900
142	pressure-side	0.124	0.086	0.900
143	pressure-side	0.125	0.084	0.900
144	pressure-side	0.127	0.082	0.900
145	pressure-side	0.128	0.081	0.900
146	pressure-side	0.129	0.079	0.900
147	pressure-side	0.130	0.077	0.900
148	pressure-side	0.131	0.075	0.900
149	pressure-side	0.133	0.074	0.900
150	pressure-side	0.134	0.072	0.900
151	pressure-side	0.135	0.070	0.900
152	pressure-side	0.136	0.068	0.900
153	pressure-side	0.137	0.066	0.900
154	pressure-side	0.138	0.065	0.900
155	pressure-side	0.139	0.063	0.900
156	pressure-side	0.141	0.061	0.900
157	pressure-side	0.142	0.059	0.900
158	pressure-side	0.143	0.057	0.900
159	pressure-side	0.144	0.056	0.900
160	pressure-side	0.145	0.054	0.900
161	pressure-side	0.146	0.052	0.900
162	pressure-side	0.147	0.050	0.900
163	pressure-side	0.149	0.048	0.900
164	pressure-side	0.150	0.047	0.900
165	pressure-side	0.151	0.045	0.900
166	pressure-side	0.152	0.043	0.900
167	pressure-side	0.153	0.041	0.900
168	pressure-side	0.154	0.040	0.900
169	pressure-side	0.155	0.038	0.900
170	pressure-side	0.157	0.036	0.900
171	pressure-side	0.158	0.034	0.900
172	pressure-side	0.159	0.032	0.900
173	pressure-side	0.160	0.031	0.900
174	pressure-side	0.161	0.029	0.900
175	pressure-side	0.162	0.027	0.900
176	pressure-side	0.163	0.025	0.900
177	pressure-side	0.164	0.023	0.900
178	pressure-side	0.166	0.022	0.900
179	pressure-side	0.167	0.020	0.900
180	pressure-side	0.168	0.018	0.900
181	pressure-side	0.169	0.016	0.900
182	pressure-side	0.170	0.014	0.900
183	pressure-side	0.171	0.013	0.900
184	pressure-side	0.173	0.011	0.900
185	pressure-side	0.174	0.009	0.900
186	pressure-side	0.175	0.007	0.900
187	pressure-side	0.176	0.006	0.900
188	pressure-side	0.177	0.004	0.900
189	pressure-side	0.178	0.002	0.900
190	pressure-side	0.180	0.000	0.900
191	pressure-side	0.181	−0.001	0.900
192	pressure-side	0.182	−0.003	0.900
193	pressure-side	0.183	−0.005	0.900
194	pressure-side	0.185	−0.007	0.900
195	pressure-side	0.186	−0.008	0.900
196	pressure-side	0.186	−0.008	0.900
197	pressure-side	0.187	−0.008	0.900
198	pressure-side	0.188	−0.008	0.900
199	pressure-side	0.188	−0.008	0.900
200	pressure-side	0.188	−0.008	0.900
1	suction-side	0.081	0.145	1.000

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
2	suction-side	0.083	0.146	1.000
3	suction-side	0.085	0.146	1.000
4	suction-side	0.087	0.146	1.000
5	suction-side	0.089	0.146	1.000
6	suction-side	0.090	0.145	1.000
7	suction-side	0.092	0.144	1.000
8	suction-side	0.094	0.143	1.000
9	suction-side	0.095	0.142	1.000
10	suction-side	0.097	0.141	1.000
11	suction-side	0.099	0.140	1.000
12	suction-side	0.100	0.139	1.000
13	suction-side	0.102	0.137	1.000
14	suction-side	0.103	0.136	1.000
15	suction-side	0.104	0.135	1.000
16	suction-side	0.106	0.133	1.000
17	suction-side	0.107	0.132	1.000
18	suction-side	0.108	0.130	1.000
19	suction-side	0.110	0.129	1.000
20	suction-side	0.111	0.127	1.000
21	suction-side	0.112	0.126	1.000
22	suction-side	0.113	0.124	1.000
23	suction-side	0.114	0.123	1.000
24	suction-side	0.116	0.121	1.000
25	suction-side	0.117	0.120	1.000
26	suction-side	0.118	0.118	1.000
27	suction-side	0.119	0.117	1.000
28	suction-side	0.120	0.115	1.000
29	suction-side	0.121	0.113	1.000
30	suction-side	0.122	0.112	1.000
31	suction-side	0.123	0.110	1.000
32	suction-side	0.124	0.109	1.000
33	suction-side	0.125	0.107	1.000
34	suction-side	0.126	0.105	1.000
35	suction-side	0.127	0.104	1.000
36	suction-side	0.128	0.102	1.000
37	suction-side	0.129	0.100	1.000
38	suction-side	0.130	0.099	1.000
39	suction-side	0.131	0.097	1.000
40	suction-side	0.132	0.095	1.000
41	suction-side	0.133	0.094	1.000
42	suction-side	0.134	0.092	1.000
43	suction-side	0.135	0.091	1.000
44	suction-side	0.136	0.089	1.000
45	suction-side	0.137	0.087	1.000
46	suction-side	0.138	0.086	1.000
47	suction-side	0.139	0.084	1.000
48	suction-side	0.140	0.082	1.000
49	suction-side	0.142	0.081	1.000
50	suction-side	0.143	0.079	1.000
51	suction-side	0.144	0.077	1.000
52	suction-side	0.145	0.076	1.000
53	suction-side	0.146	0.074	1.000
54	suction-side	0.147	0.073	1.000
55	suction-side	0.148	0.071	1.000
56	suction-side	0.149	0.069	1.000
57	suction-side	0.150	0.068	1.000
58	suction-side	0.151	0.066	1.000
59	suction-side	0.152	0.064	1.000
60	suction-side	0.153	0.063	1.000
61	suction-side	0.154	0.061	1.000
62	suction-side	0.155	0.059	1.000
63	suction-side	0.156	0.058	1.000
64	suction-side	0.157	0.056	1.000
65	suction-side	0.158	0.055	1.000
66	suction-side	0.159	0.053	1.000
67	suction-side	0.160	0.051	1.000
68	suction-side	0.161	0.050	1.000
69	suction-side	0.162	0.048	1.000
70	suction-side	0.163	0.046	1.000
71	suction-side	0.164	0.045	1.000
72	suction-side	0.165	0.043	1.000
73	suction-side	0.166	0.042	1.000
74	suction-side	0.167	0.040	1.000
75	suction-side	0.168	0.038	1.000
76	suction-side	0.169	0.037	1.000
77	suction-side	0.170	0.035	1.000

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
78	suction-side	0.171	0.033	1.000
79	suction-side	0.172	0.032	1.000
80	suction-side	0.173	0.030	1.000
81	suction-side	0.174	0.029	1.000
82	suction-side	0.175	0.027	1.000
83	suction-side	0.176	0.025	1.000
84	suction-side	0.177	0.024	1.000
85	suction-side	0.178	0.022	1.000
86	suction-side	0.179	0.020	1.000
87	suction-side	0.180	0.019	1.000
88	suction-side	0.181	0.017	1.000
89	suction-side	0.182	0.016	1.000
90	suction-side	0.184	0.014	1.000
91	suction-side	0.185	0.012	1.000
92	suction-side	0.186	0.011	1.000
93	suction-side	0.187	0.009	1.000
94	suction-side	0.187	0.004	1.000
95	suction-side	0.188	0.007	1.000
96	suction-side	0.188	0.004	1.000
97	suction-side	0.188	0.005	1.000
98	suction-side	0.188	0.005	1.000
99	suction-side	0.188	0.006	1.000
100	suction-side	0.188	0.006	1.000
101	pressure-side	0.081	0.143	1.000
102	pressure-side	0.081	0.145	1.000
103	pressure-side	0.082	0.142	1.000
104	pressure-side	0.084	0.140	1.000
105	pressure-side	0.085	0.139	1.000
106	pressure-side	0.087	0.138	1.000
107	pressure-side	0.089	0.137	1.000
108	pressure-side	0.090	0.136	1.000
109	pressure-side	0.092	0.135	1.000
110	pressure-side	0.094	0.134	1.000
111	pressure-side	0.095	0.133	1.000
112	pressure-side	0.097	0.132	1.000
113	pressure-side	0.098	0.131	1.000
114	pressure-side	0.100	0.130	1.000
115	pressure-side	0.101	0.129	1.000
116	pressure-side	0.103	0.128	1.000
117	pressure-side	0.104	0.126	1.000
118	pressure-side	0.105	0.125	1.000
119	pressure-side	0.106	0.124	1.000
120	pressure-side	0.108	0.122	1.000
121	pressure-side	0.109	0.121	1.000
122	pressure-side	0.110	0.119	1.000
123	pressure-side	0.111	0.118	1.000
124	pressure-side	0.112	0.116	1.000
125	pressure-side	0.114	0.115	1.000
126	pressure-side	0.115	0.113	1.000
127	pressure-side	0.116	0.112	1.000
128	pressure-side	0.117	0.110	1.000
129	pressure-side	0.118	0.109	1.000
130	pressure-side	0.119	0.107	1.000
131	pressure-side	0.120	0.105	1.000
132	pressure-side	0.121	0.104	1.000
133	pressure-side	0.122	0.102	1.000
134	pressure-side	0.123	0.101	1.000
135	pressure-side	0.124	0.099	1.000
136	pressure-side	0.125	0.097	1.000
137	pressure-side	0.126	0.096	1.000
138	pressure-side	0.127	0.094	1.000
139	pressure-side	0.128	0.093	1.000
140	pressure-side	0.129	0.091	1.000
141	pressure-side	0.130	0.089	1.000
142	pressure-side	0.131	0.088	1.000
143	pressure-side	0.132	0.086	1.000
144	pressure-side	0.133	0.085	1.000
145	pressure-side	0.134	0.083	1.000
146	pressure-side	0.135	0.082	1.000
147	pressure-side	0.136	0.080	1.000
148	pressure-side	0.137	0.078	1.000
149	pressure-side	0.138	0.077	1.000
150	pressure-side	0.139	0.075	1.000
151	pressure-side	0.140	0.074	1.000
152	pressure-side	0.141	0.072	1.000
153	pressure-side	0.142	0.070	1.000

TABLE I-continued

Non-Dimensionalized (X Y Z/Span)				
N	Location	X	Y	Z
154	pressure-side	0.143	0.069	1.000
155	pressure-side	0.144	0.067	1.000
156	pressure-side	0.146	0.066	1.000
157	pressure-side	0.147	0.064	1.000
158	pressure-side	0.148	0.062	1.000
159	pressure-side	0.149	0.061	1.000
160	pressure-side	0.150	0.059	1.000
161	pressure-side	0.151	0.058	1.000
162	pressure-side	0.152	0.056	1.000
163	pressure-side	0.153	0.054	1.000
164	pressure-side	0.154	0.053	1.000
165	pressure-side	0.155	0.051	1.000
166	pressure-side	0.156	0.050	1.000
167	pressure-side	0.157	0.048	1.000
168	pressure-side	0.158	0.046	1.000
169	pressure-side	0.159	0.045	1.000
170	pressure-side	0.160	0.043	1.000
171	pressure-side	0.161	0.042	1.000
172	pressure-side	0.162	0.040	1.000
173	pressure-side	0.163	0.038	1.000
174	pressure-side	0.164	0.037	1.000
175	pressure-side	0.165	0.035	1.000
176	pressure-side	0.166	0.034	1.000
177	pressure-side	0.167	0.032	1.000
178	pressure-side	0.168	0.030	1.000
179	pressure-side	0.169	0.029	1.000
180	pressure-side	0.170	0.027	1.000
181	pressure-side	0.171	0.026	1.000
182	pressure-side	0.172	0.024	1.000
183	pressure-side	0.173	0.022	1.000
184	pressure-side	0.174	0.021	1.000
185	pressure-side	0.175	0.019	1.000
186	pressure-side	0.176	0.018	1.000
187	pressure-side	0.177	0.016	1.000
188	pressure-side	0.178	0.014	1.000
189	pressure-side	0.179	0.013	1.000
190	pressure-side	0.180	0.011	1.000
191	pressure-side	0.181	0.010	1.000
192	pressure-side	0.182	0.008	1.000
193	pressure-side	0.183	0.007	1.000
194	pressure-side	0.184	0.005	1.000
195	pressure-side	0.186	0.004	1.000
196	pressure-side	0.186	0.004	1.000
197	pressure-side	0.186	0.004	1.000
198	pressure-side	0.187	0.004	1.000
199	pressure-side	0.187	0.004	1.000
200	pressure-side	0.187	0.004	1.000

The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the disclosure. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" and/or "comprising," when used in this specification, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they have structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

What is claimed is:

1. In a turbomachine including a row of substantially identical buckets circumferentially mounted on a rotor, each bucket including a respective airfoil with opposed pressure and suction sidewalls extending chordwise between opposed leading and trailing edges and spanwise between a root and a tip, a flow passage between each pair of airfoils, each flow passage comprising:

a pressure sidewall of a first airfoil;

a suction sidewall of a second airfoil substantially facing the pressure sidewall of the first airfoil; and

a throat including an area defined at least in part by a minimum gap between the pressure sidewall of the first airfoil and the suction sidewall of the second airfoil for each corresponding chord along spans of the first and second airfoils, a width of the throat at at least one of the tips or the roots of the airfoils being no more than about 15% more than a width of the throat at a respective first or second distance from the at least one of the tips or the roots.

2. The flow passage of claim **1**, wherein the first distance is no more than about 25% of the span of one of the first airfoil or the second airfoil.

3. The flow passage of claim **2**, wherein the first distance is no more than about 20% of the span of the one of the first airfoil or the second airfoil.

4. The flow passage of claim **1**, wherein the width of the throat increases by no more than about 10% of a width of the throat at the at least one of the first or second distance.

5. The flow passage of claim **1**, wherein an absolute value of a rate of change of the width of the throat versus span increases with decreasing distance to at least one of the tips or the roots of the first and second airfoils within the first distance from the at least one of the tips or the roots.

6. The flow passage of claim **1**, wherein the first distance and the second distance are no more than about 20% of a span of the first airfoil, a width of the throat at the tips is no more than about 10% wider than the width of the throat at the first distance, and a width of the throat at the roots is no more than about 10% wider than the width of the throat at the second distance.

7. The flow passage of claim **1**, wherein at least one of the suction sidewall or the pressure sidewall of at least one airfoil includes a nominal profile substantially in accordance with non-dimensional Cartesian coordinate values of X, Y, and Z set forth in TABLE I, wherein the coordinate values are non-dimensionalized and convertible to distances by multiplying the coordinate values by a desired span in units of distance, and wherein X and Y values connected by smooth continuing arcs define profile sections of the at least one of the suction sidewall or the pressure sidewall at each distance Z along the airfoil, the profile sections at the Z distances being joined smoothly with one another to form the profile of the at least one of the suction sidewall or the pressure sidewall.

8. The flow passage of claim **1**, further comprising a first end bounded at least in part by a first endwall extending between one of the roots or the tips of the first and second airfoils.

9. The flow passage of claim **8**, wherein the row of substantially identical buckets is part of a diffuser of an axial turbine.

10. The flow passage of claim **1**, wherein the row of substantially identical buckets is in a last stage of an axial turbine.

11. A stage of a turbine comprising:

a plurality of airfoils mounted on a rotor of a turbine about an axis of rotation of the turbine in a substantially circumferential, spaced-apart fashion, each airfoil including respective opposed pressure and suction sidewalls extending chordwise between respective opposed leading and trailing edges and spanwise between opposed inner and outer endwalls, a respective root of each airfoil connected to one of the inner and outer endwalls, and at least one of the suction sidewall or the pressure sidewall including a nominal profile substantially in accordance with non-dimensional Cartesian coordinate values of X, Y, and Z set forth in TABLE I, wherein the coordinate values are non-dimensionalized and convertible to distances by multiplying the coordinate values by a desired span in units of distance, and wherein X and Y values connected by smooth continuing arcs define profile sections of the at least one of the suction sidewall or the pressure sidewall at each distance Z along the airfoil, the profile sections at the Z distances being joined smoothly with one another to form the profile of the at least one of the suction sidewall or the pressure sidewall; and

a total throat including a component throat between adjacent airfoils of the plurality of airfoils, each component throat including a minimum gap between a pressure sidewall of a first airfoil and a suction sidewall of a second airfoil adjacent to the first airfoil for all corresponding points along spans of the first and second airfoils, a width of the component throat increasing with decreasing distance to at least one of the tips of the roots within a first distance away from the at least one of the tips or the roots.

12. The turbine nozzle of claim **11**, wherein an absolute value of a rate of change of the width of the component throat with respect to span also increases with decreasing distance to the at least one of the tips of the roots within the first distance away from the at least one of the tips or the roots.

13. The turbine nozzle of claim **11**, wherein the width of the component throat at at least one of the tips or the roots is no more than about 15% wider than a respective width of the component throat at the first distance away from the respective at least one of the tips or the roots.

14. The turbine nozzle of claim **13**, wherein the width of the component throat at the tips is no more than about 115% of the width of the component throat at about 75% span.

15. The turbine nozzle of claim **13**, wherein width of the component throat at the roots is no more than about 115% of the width of the component throat at about 25% span.

16. The turbine nozzle of claim **11**, wherein the stage is a last stage of an axial turbine.

17. The turbine nozzle of claim **11**, wherein both the pressure sidewall and the suction sidewall of each airfoil includes a nominal profile substantially in accordance with non-dimensional Cartesian coordinate values of X, Y, and Z set forth in TABLE I, wherein the coordinate values are convertible to distances by multiplying the values by a desired span expressed in units of distance, and wherein X and Y values connected by smooth continuing arcs define airfoil profile sections at each distance Z along the airfoil, the profile sections at the Z distances being joined smoothly with one another to form the airfoil profile.

18. A turbine system comprising:

a compressor section;

a combustion section; and

a turbine section, wherein a stage of the turbine section includes a plurality of substantially identical airfoils substantially circumferentially spaced apart about an axis of rotation of the turbine section, each airfoil including opposed pressure and suction sidewalls extending chordwise between opposed leading and trailing edges and spanwise between opposed respective roots and tips, and at least one of the suction sidewall or the pressure sidewall of each airfoil including a nominal profile substantially in accordance with non-dimensional Cartesian coordinate values of X, Y, and Z set forth in TABLE I, wherein the coordinate values are non-dimensionalized and convertible to distances by multiplying the coordinate values by a desired span in units of distance, and wherein X and Y values connected by smooth continuing arcs define profile sections of the at least one of the suction sidewall or the pressure sidewall at each distance Z along the airfoil, the profile sections at the Z distances being joined smoothly with one another to form the profile of the at least one of the suction sidewall or the pressure sidewall; and

a total throat including a component throat between each pair of adjacent airfoils, each component throat including an area defined at least in part by a minimum gap between a pressure sidewall of a first airfoil and a suction sidewall of an adjacent second airfoil for all points along spans of the first and second airfoils.

19. The turbine system of claim **18**, wherein a width of the component throat increases with decreasing distance to the roots of the first and second airfoils within a first distance from the roots and within a second distance from the tips, and at least one of the first distance or the second distance is no more than 25% of the spans of the first and second airfoils.

20. The turbine system of claim **18**, wherein a width of the component throat at at least one of the roots or the tips is no more than about 110% of the width of the component throat at about 20% span away from the respective at least one of the roots or the tips.

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