1. **Participant Information**

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| Submission year: | 2022 |

1. **Grid Information**

If this submission used an official grid:

|  |  |
| --- | --- |
| Grid name (e.g., medium, fine, etc.): |  |
| Has pinched rotor casing?\* (yes/no) |  |
| Has stator hub cavity? (yes/no) |  |

\* The official grids released in the 2021 1st GPPS CFD Workshop used a smooth rotor casing (not realistic). The official grids released in the 2022 2nd GPPS CFD Workshop has fixed this error with realistic pinched casing.

If this submission used an in-house grid:

|  |  |
| --- | --- |
| Average y+ of the first layer grid: | 1.5 |
| Number of grid points in the rotor domain: | 1.56 million |
| Number of grid points in the stator domain: | 0.96 million |
| Type of grid element:  (e.g., hexahedron, tetrahedron, etc.) | hexahedron |
| Has pinched rotor casing?\* (yes/no) | No |
| Has realistic rotor and stator fillets? (yes/no) | no |

1. **RANS Flow Solver Information**

(1) General:

|  |  |
| --- | --- |
| Solver name: | ANSYS Fluent 19.2 |
| Version number: |  |
| Major reference(s) (optional): |  |

(2) Advection Scheme:

|  |  |
| --- | --- |
| Branch of scheme (e.g., JST, ROE, AUSM): | PBCS |
| If not listed above, please briefly describe the advection scheme and include a major reference to the scheme:  Pressure-based pressure-velocity coupled scheme (second-order upwind discretization)  The coupled algorithm solves the momentum and pressure-based continuity equations together. The full implicit coupling is achieved through an implicit discretization of pressure gradient terms in the momentum equations, and an implicit discretization of the face mass flux, including the Rhie-Chow pressure dissipation terms.  Reference: ANSYS\_FLUENT 19.2\_Theory\_Guide | |

(3) Turbulence Model:

|  |  |
| --- | --- |
| Model name\*: | SST-2003-Helicity |
| If not documented in NASA TMR, please briefly describe the turbulence model and include a major reference to it:  This model is an improved SST model which is in analogy with the one-equation SA-noft2-Helicity model. The velocity helicity correction was introduced into the two-equation SST-2003 model, formulating SST-2003-Helicity model.  Reference:   * Liu Y, Lu L, Fang L, Gao F. Modification of Spalart-Allmaras model with consideration of turbulence energy backscatter using velocity helicity. *Phys lett, A* 2011;375(24):2377-2381. * Liu Y, Tang Y, Scillitoe AD, Tucker PG. Modification of shear stress transport turbulence model using helicity for predicting corner separation flow in a linear compressor cascade. *J Turbomach* 2020;142(2): 021004. | |

\*Please follow the naming convention of [NASA TMR](https://turbmodels.larc.nasa.gov/). Note that the turbulence model implemented in the solver may differ from the standard version of the model (e.g., SA vs. SA-noft2, SST vs. SST-2003, etc.)

(4) Viscous wall treatment:

|  |  |
| --- | --- |
| Use of wall function (yes/no): | no |
| Use in-house grid with y+ > 10 (yes/no): | no |
| If both yes, please briefly describe the wall function and include a major reference to it: | |

(5) Rotor-stator interface model:

|  |  |
| --- | --- |
| Type of model for mean flow quantities\*:  (e.g., frozen rotor, mixing plane, non-reflecting (Giles)) | Mixing plane |
| Type of model for turbulence quantities\*:  (e.g., frozen rotor, mixing plane) | Mixing plane |
| Please briefly describe the rotor-stator interface model and include a major reference to it (optional): | |

\* Mean flow quantities are *p*, *T*, *u*x, *u*y, *u*z, etc.; turbulence quantities are eddy viscosity, *k*, *ω*, etc.

(6) Other details (optional):

|  |  |
| --- | --- |
| Fluid model (e.g., real gas, idea gas): | Ideal gas |
| Linear system solver (e.g., Jacobi, etc.): | Incomplete Lower Upper (ILU) |
| Have you verified your solver in [NASA 2D flat plate](https://turbmodels.larc.nasa.gov/flatplate.html) against established RANS solvers? (yes/no) | no |

1. **Boundary conditions**

(1) Inlet:

|  |  |
| --- | --- |
| How were the mean flow quantities determined? (e.g., from InletBC.input file; uniform inlet at standard conditions) | from measured profiles |
|  | 图表, 散点图  描述已自动生成 |
| 图表  低可信度描述已自动生成 | 图表, 散点图  描述已自动生成 |
| How was the turbulence quantity(s) determined? (e.g., values and units of inlet *k* and *ω*) | From “InletBC.input” file (turbulent intensity 4% & length scale 9e-05m) |

(2) Outlet (optional):

|  |  |
| --- | --- |
| What type of boundary condition is used? (e.g., uniform backpressure, radial equilibrium backpressure, mass flow, Riemann, etc.) | radial equilibrium backpressure |

(3) Periodic boundary (optional):

|  |  |
| --- | --- |
| Have you checked the periodicity of mean flow quantities? (yes/no) | yes |
| Have you checked the periodicity of turbulence quantities? (yes/no) | yes |

1. **Convergence History**

A figure of mass flow rate (rotor inlet, rotor exit/stator inlet, and stator exit) versus iteration

|  |  |
| --- | --- |
| Peak efficiency condition (16.00 ± 0.10 kg/s) | Near stall condition (14.78 ± 0.10 kg/s) |
|  | 图表, 折线图  描述已自动生成 |

A figure of residual versus iteration (optional)

|  |  |
| --- | --- |
| Which quantity's residuals are plotted? |  |
| How was the residual defined? (global or local; maximum or average; absolute or relative, etc.) |  |
| Peak efficiency condition (16.00 ± 0.10 kg/s) | Near stall condition (14.78 ± 0.10 kg/s) |
|  |  |