Title

Axial Compressor Rotor Report

Date

2024/08/03 15:03:49

Contents

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1. File Report

Table 1. File Information for Rotor 37_003

Case	Rotor 37_003
File Path	D:/ANSYS/ROTOR 37/SOLUTION/Rotor 37_003.res
File Date	03 August 2024
File Time	02:14:05 PM
File Type	CFX5
File Version	24.1

2. Mesh Report

Table 2. Mesh Information for Rotor 37_003

Domain	Nodes	Elements
R1	158309	147882

Table 3. Mesh Statistics for Rotor 37_003

Domain	Maximum Edge Length Ratio
R1	235.171

3. Physics Report

Table 4. Domain Physics for Rotor 37_003

Domain - R1	
Type	Fluid
Location	Passage
Materials	
Air Ideal Gas	
Fluid Definition	Material Library
Morphology	Continuous Fluid
Settings	
Buoyancy Model	Non Buoyant
Domain Motion	Rotating
Alternate Rotation Model	true
Angular Velocity	1.7189e+4 [rev min^-1]
Axis Definition	Coordinate Axis
Rotation Axis	Coord 0.1
Reference Pressure	0.0000e+0 [atm]
Heat Transfer Model	Total Energy
Include Viscous Work Term	True
Turbulence Model	k epsilon
Turbulent Wall Functions	Scalable
High Speed Model	Off
Domain Interface - R1 to R1 Internal	
Boundary List1	R1 to R1 Internal Side 1
Boundary List2	R1 to R1 Internal Side 2
Interface Type	Fluid Fluid
Settings	
Interface Models	General Connection
Mass And Momentum	Conservative Interface Flux
Mesh Connection	GGI
Domain Interface - R1 to R1 Periodic 1	
Boundary List1	R1 to R1 Periodic 1 Side 1
Boundary List2	R1 to R1 Periodic 1 Side 2
Interface Type	Fluid Fluid
Settings	
Interface Models	Rotational Periodicity
Axis Definition	Coordinate Axis
Rotation Axis	Coord 0.1
Mesh Connection	Automatic

Table 5. Boundary Physics for Rotor 37_003

Domain	**Boundaries**	
R1	**Boundary - R1 Inlet**	
	Type	INLET

Location	INFLOW
Settings	
Flow Direction	Normal to Boundary Condition
Flow Regime	Subsonic
Heat Transfer	Stationary Frame Total Temperature
Stationary Frame Total Temperature	2.8815e+2 [K]
Mass And Momentum	Stationary Frame Total Pressure
Relative Pressure	1.0000e+0 [atm]
Turbulence	Medium Intensity and Eddy Viscosity Ratio
Boundary - R1 to R1 Internal Side 1	
Type	INTERFACE
Location	SHROUD TIP GGI SIDE 1
Settings	
Heat Transfer	Conservative Interface Flux
Mass And Momentum	Conservative Interface Flux
Turbulence	Conservative Interface Flux
Boundary - R1 to R1 Internal Side 2	
Type	INTERFACE
Location	SHROUD TIP GGI SIDE 2
Settings	
Heat Transfer	Conservative Interface Flux
Mass And Momentum	Conservative Interface Flux
Turbulence	Conservative Interface Flux
Boundary - R1 to R1 Periodic 1 Side 1	
Type	INTERFACE
Location	PER1
Settings	
Heat Transfer	Conservative Interface Flux
Mass And Momentum	Conservative Interface Flux
Turbulence	Conservative Interface Flux
Boundary - R1 to R1 Periodic 1 Side 2	
Type	INTERFACE
Location	PER2
Settings	
Heat Transfer	Conservative Interface Flux
Mass And Momentum	Conservative Interface Flux
Turbulence	Conservative Interface Flux
Boundary - R1 Outlet	
Type	OUTLET
Location	OUTFLOW
Settings	
Flow Regime	Subsonic
Mass And Momentum	Average Static Pressure
Pressure Profile Blend	5.0000e-2
Relative Pressure	1.0000e+0 [atm]

Pressure Averaging	Average Over Whole Outlet
Boundary - R1 Blade	
Type	WALL
Location	BLADE
Settings	
Heat Transfer	Adiabatic
Mass And Momentum	No Slip Wall
Wall Roughness	Smooth Wall
Boundary - R1 Hub	
Type	WALL
Location	HUB
Settings	
Heat Transfer	Adiabatic
Mass And Momentum	No Slip Wall
Wall Roughness	Smooth Wall
Boundary - R1 Shroud	
Type	WALL
Location	SHROUD
Settings	
Heat Transfer	Adiabatic
Mass And Momentum	No Slip Wall
Wall Velocity	Counter Rotating Wall
Wall Roughness	Smooth Wall

Chart 1.

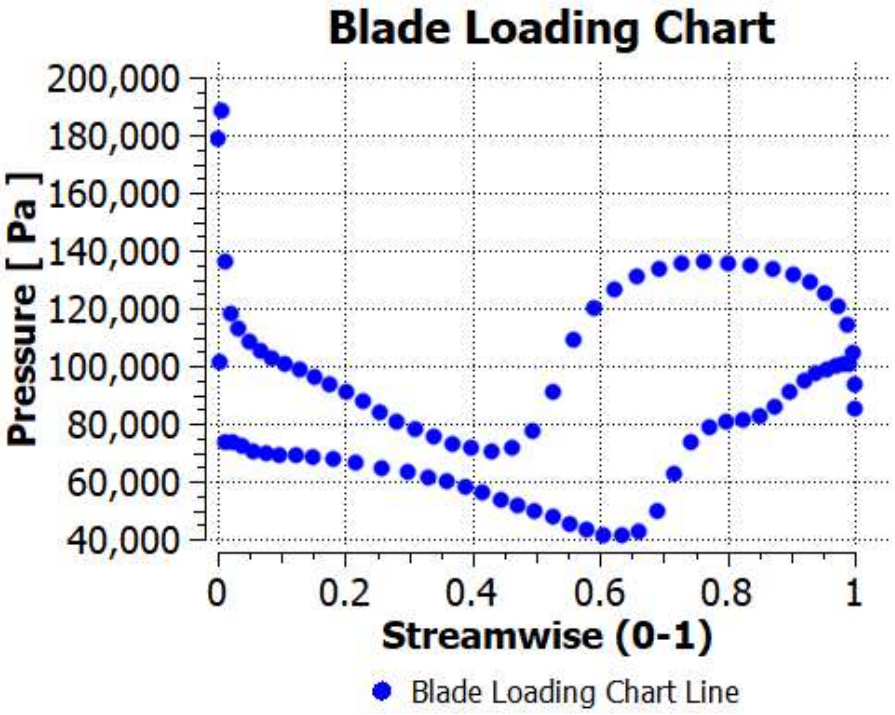


Chart 2.

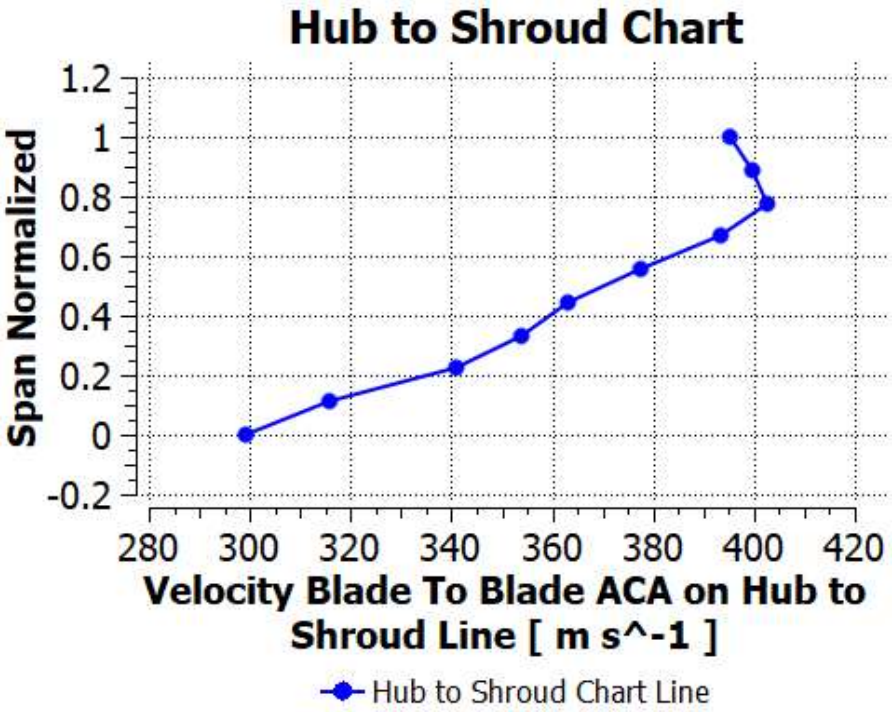


Chart 3.

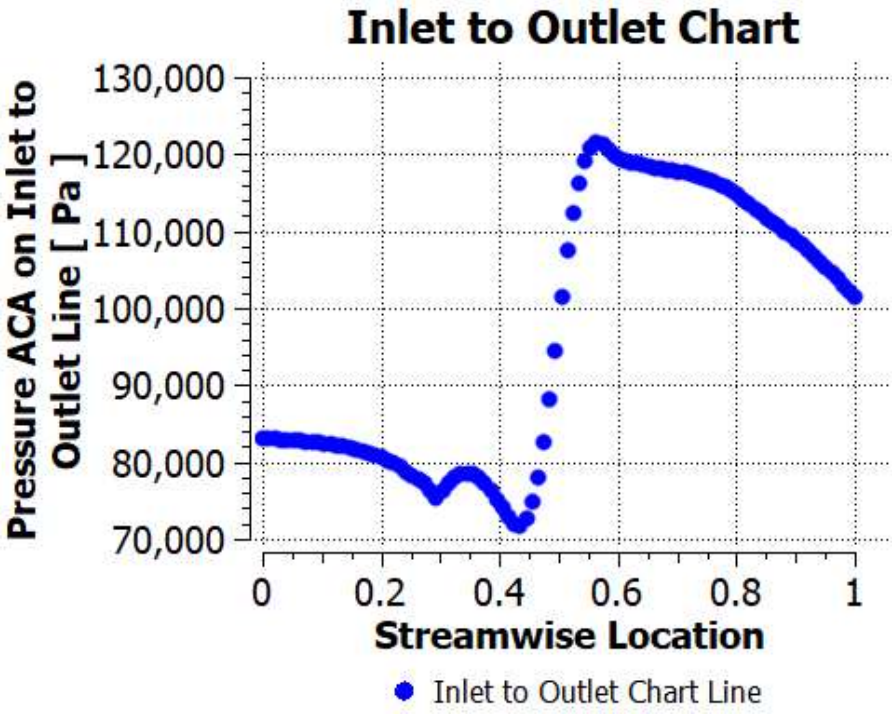


Figure 1.

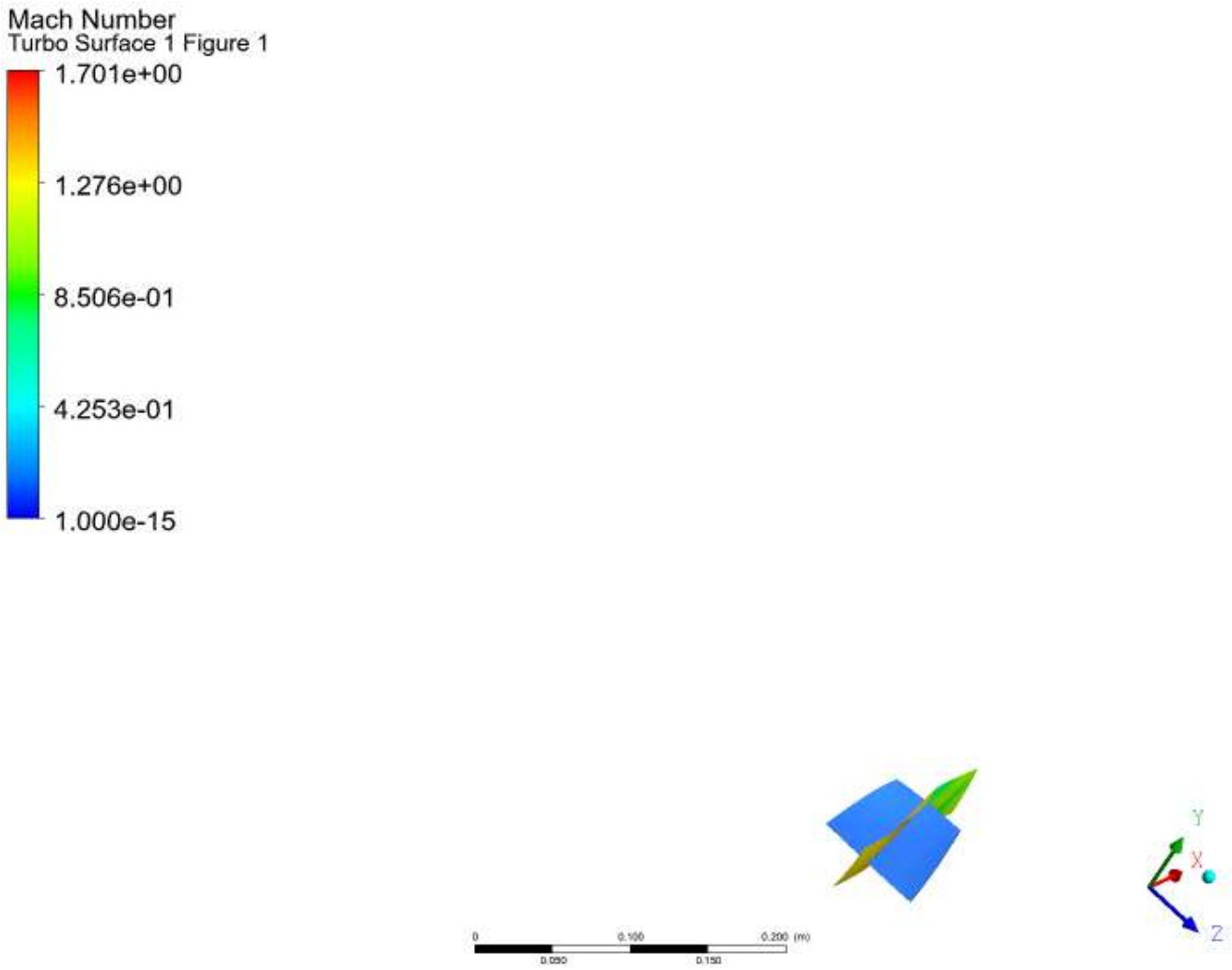

Mach Number
Turbo Surface 1 Figure 1
1.701e+00
1.276e+00
8.506e-01
4.253e-01
1.000e-15
0
0.100
0.200 (m)
0.050
0.150
Y
X
Z

Figure 2.

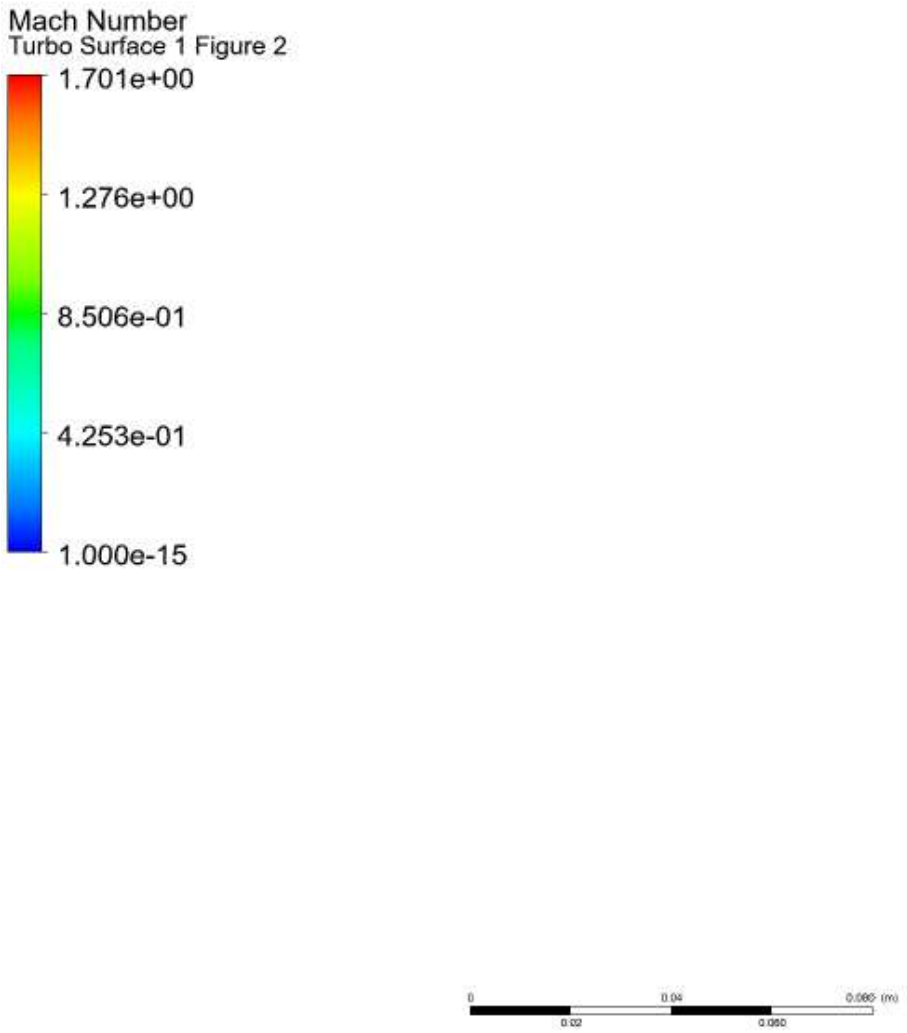


Table 6.

Mass flow rate	20.91
Mass flow rate outlet	20.91
PR	1.75
TR	1.21
Efficiency	0.82

4. Tabulated Results

The first table below gives a summary of the performance results for the axial compressor rotor. The second table lists the mass or area averaged solution variables and derived quantities computed at the inlet, leading edge (LE Cut), trailing edge (TE Cut) and outlet locations. The flow angles Alpha and Beta are relative to the meridional plane; a positive angle implies that the tangential velocity is the same direction as the machine rotation.

Table 7. Compressor Performance Results

Rotation Speed	1800.0300	[radian s^-1]
Mass Flow Rate	20.9142	[kg s^-1]
Inlet Volume Flow Rate	17.0771	[m^3 s^-1]
Input Power	1285320.0000	[W]
Reference Radius	0.2173	[m]
Inlet Flow Coefficient	0.4565	
Exit Flow Coefficient	0.7082	
Work Input Coefficient	0.4017	
Reaction	0.7979	
Total Pressure Ratio	1.7536	
Total Temperature Ratio	1.2123	
Total Isentropic Efficiency %	82.3159	
Total Polytropic Efficiency %	83.5601	

Table 8. Summary Data

Quantity	Inlet	LE Cut	TE Cut	Outlet	TE/LE	TE-LE	Units
Density	1.0628	0.9842	1.3311	1.1834	1.3525	0.3469	[kg m^-3]
Pstatic	83077.9000	75438.1000	120314.0000	101353.0000	1.5949	44875.6000	[Pa]
Ptotal	101318.0000	99965.5000	182630.0000	177669.0000	1.8269	82665.0000	[Pa]
Ptotal (rot)	101304.0000	99548.0000	93752.9000	90954.5000	0.9418	-5795.0700	[Pa]
Tstatic	272.2060	265.0340	311.4450	297.7990	1.1751	46.4106	[K]
Ttotal	288.1540	288.4740	349.1730	349.3420	1.2104	60.6993	[K]
Ttotal (rot)	288.1420	288.1440	288.1890	288.3900	1.0002	0.0450	[K]
Hstatic	-26057.8000	-33261.7000	13353.2000	-352.2880	-0.4015	46614.8000	[J kg^-1]
Htotal	-10039.9000	-9718.5800	51247.8000	51417.0000	-5.2732	60966.4000	[J kg^-1]
Rothalpy	-10052.3000	-10050.4000	-10005.2000	-9802.7500	0.9955	45.1992	[J kg^-1]
Entropy	-34.2325	-28.9899	-9.8718	-1.6089	0.3405	19.1181	[J kg^-1 K^-1]
Mach (abs)	0.5406	0.6635	0.7759	0.9293	1.1693	0.1123	
Mach (rel)	1.3062	1.3713	0.9151	1.0567	0.6673	-0.4562	
U	393.2390	391.3520	391.1440	391.0040	0.9995	-0.2076	[m s^-1]

Cm	178.5510	213.8380	204.6510	277.3330	0.9570	-9.1873	[m s^-1]
Cu	0.0341	3.2861	173.7060	158.0940	52.8616	170.4200	[m s^-1]
C	178.5580	216.0690	279.3300	319.9940	1.2928	63.2619	[m s^-1]
Distortion Parameter	1.0058	1.0158	1.0515	1.0091	1.0351	0.0356	
Flow Angle: Alpha	0.0141	1.4587	39.7740	29.7107	27.2658	38.3153	[degree]
Wu	-393.2050	-388.0670	-217.4390	-232.9100	0.5603	170.6280	[m s^-1]
W	432.3110	443.7810	303.6650	363.8300	0.6843	-140.1150	[m s^-1]
Flow Angle: Beta	-65.3659	-60.2589	-41.0043	-39.6999	0.6805	19.2546	[degree]

5. Blade Loading Charts

Chart 4. Blade Loading at 20% Span

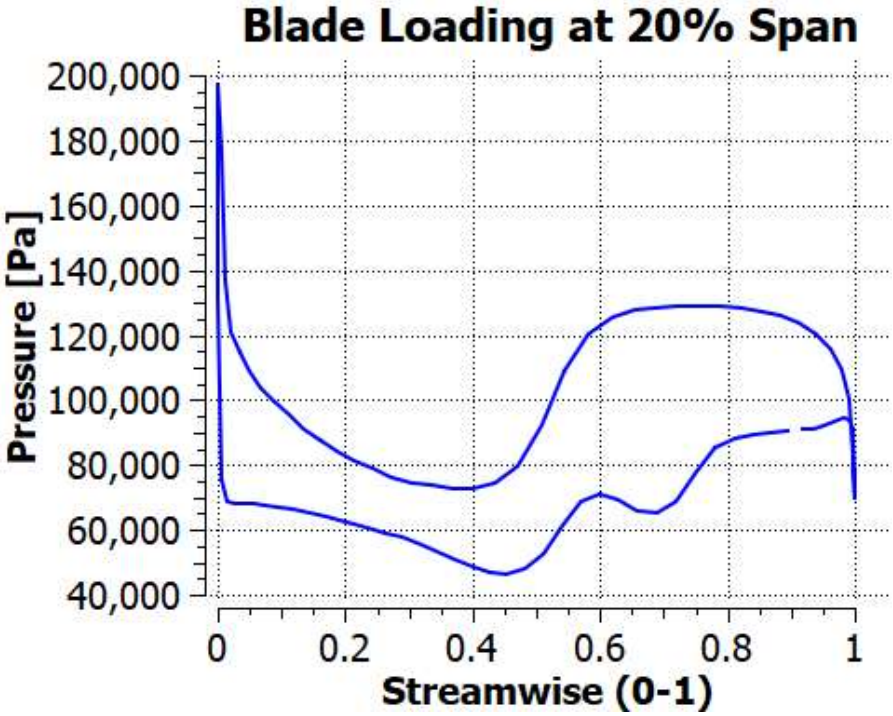


Chart 5. Blade Loading at 50% Span

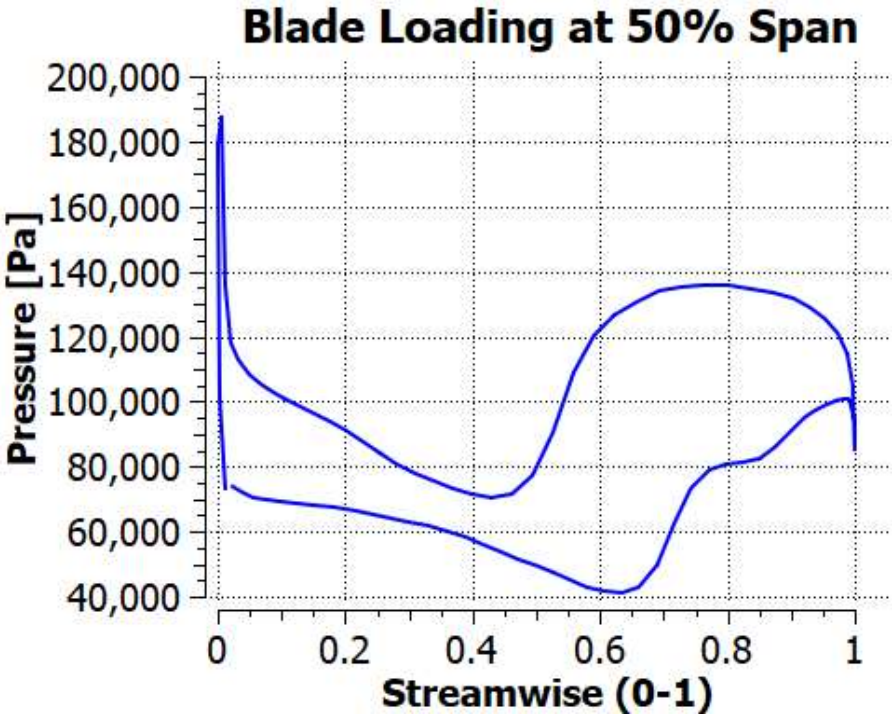
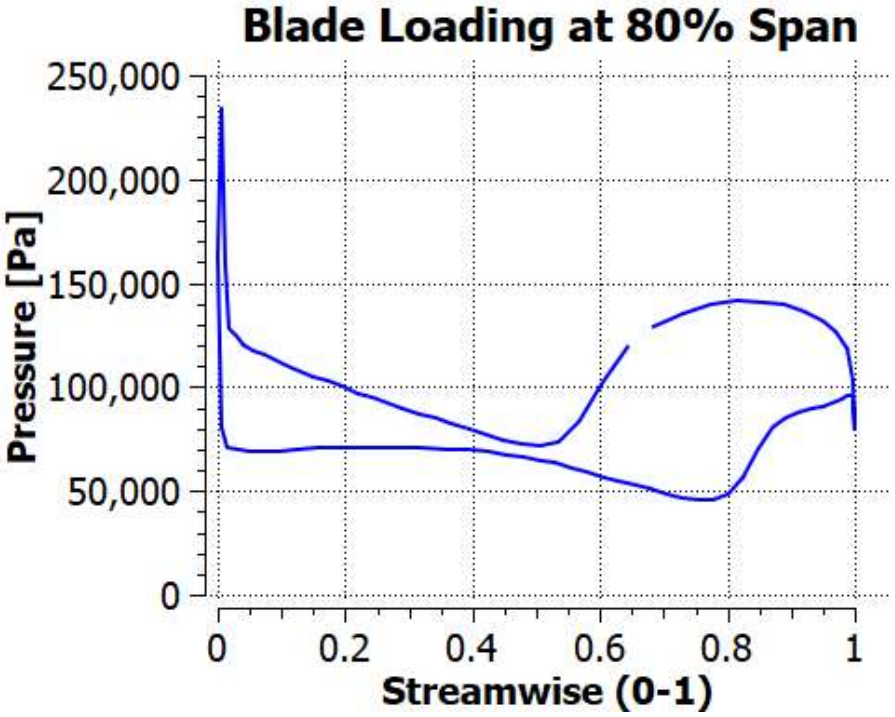


Chart 6. Blade Loading at 80% Span



6. Streamwise Charts

Chart 7. Streamwise Plot of Pt and P

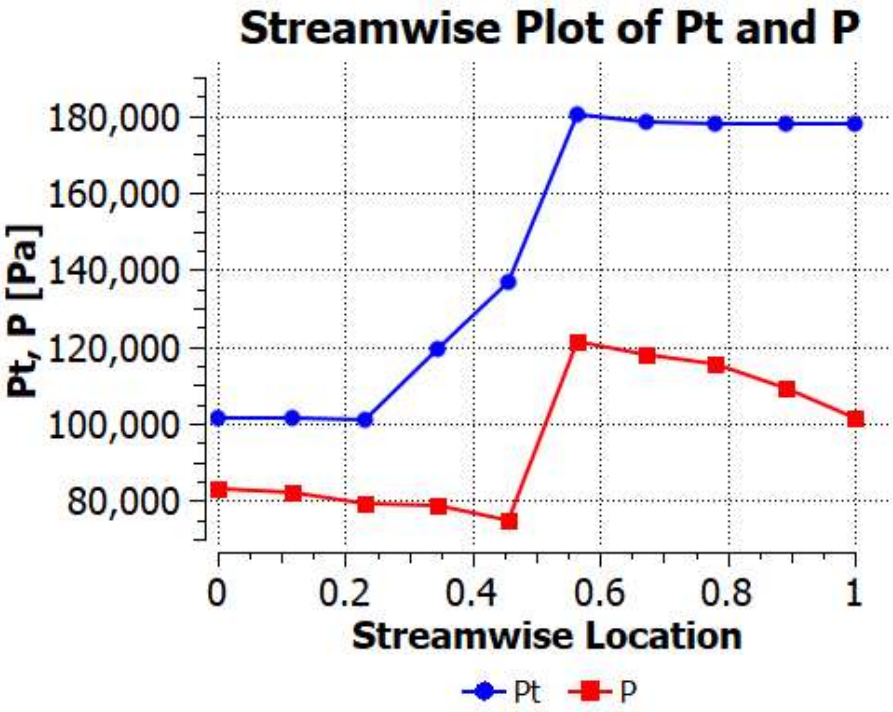


Chart 8. Streamwise Plot of Tt and T

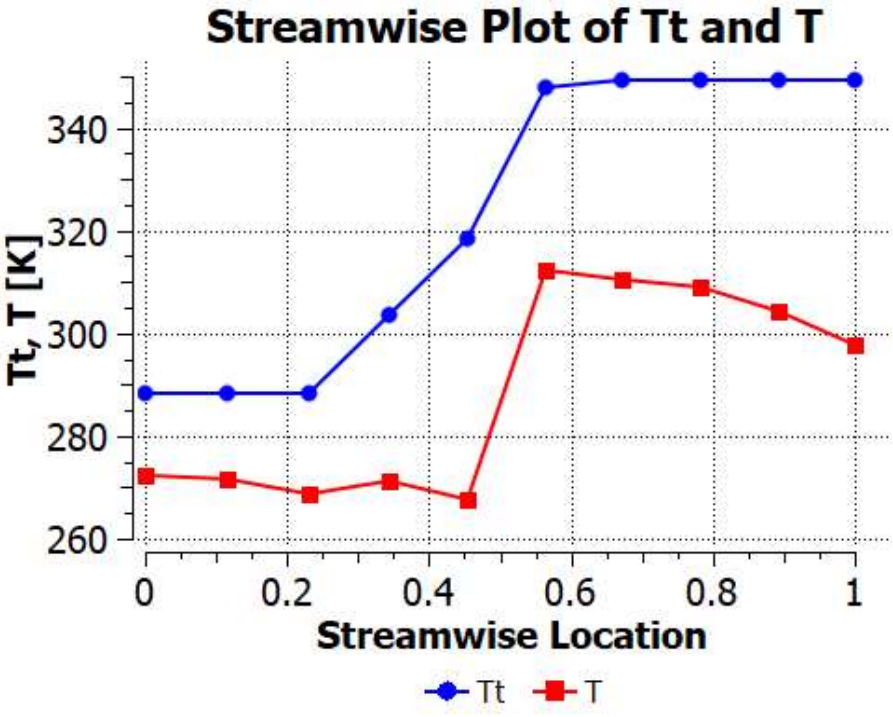


Chart 9. Streamwise Plot of Absolute and Relative Mach Number

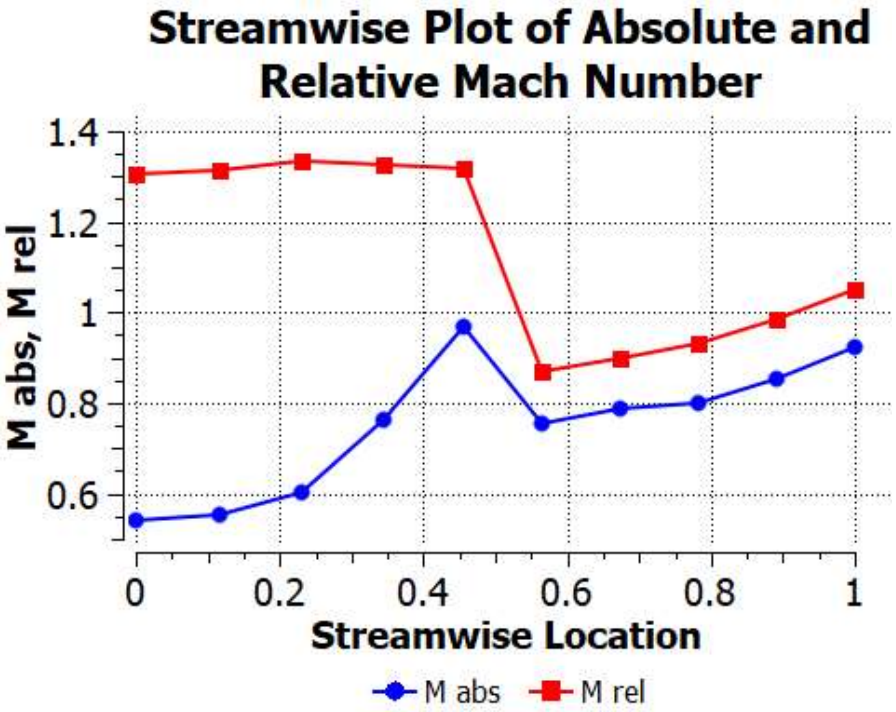
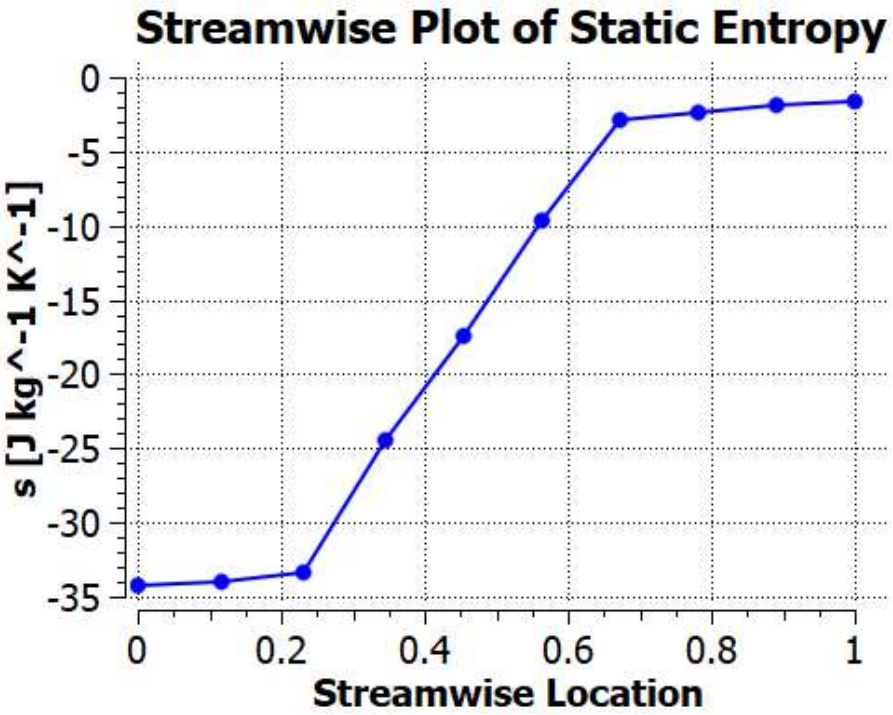


Chart 10. Streamwise Plot of Static Entropy



7. Spanwise Charts

Chart 11. Spanwise Plot of Alpha and Beta at LE

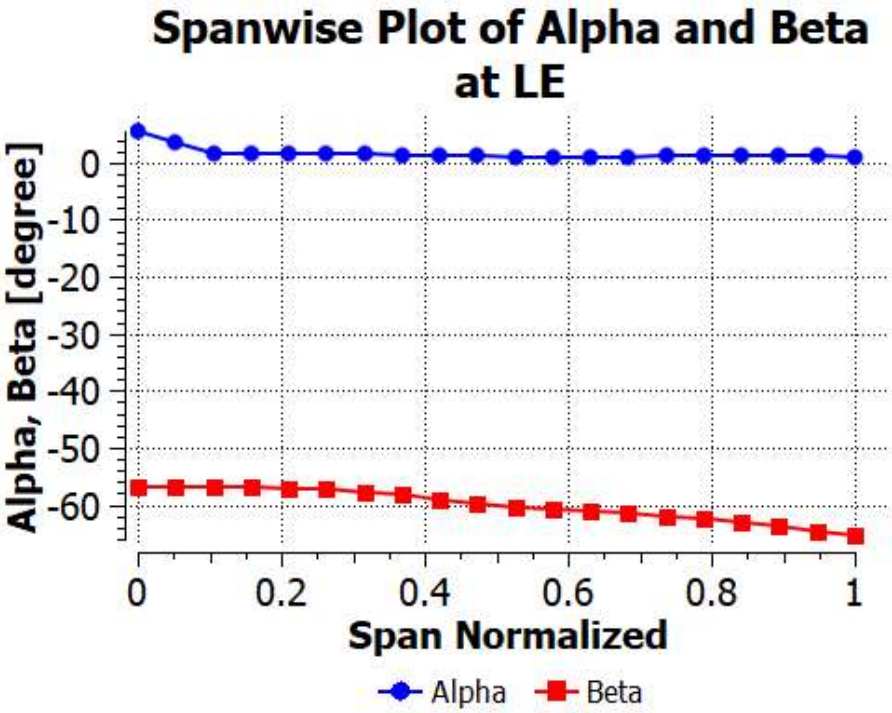


Chart 12. Spanwise Plot of Relative Mach Number at LE

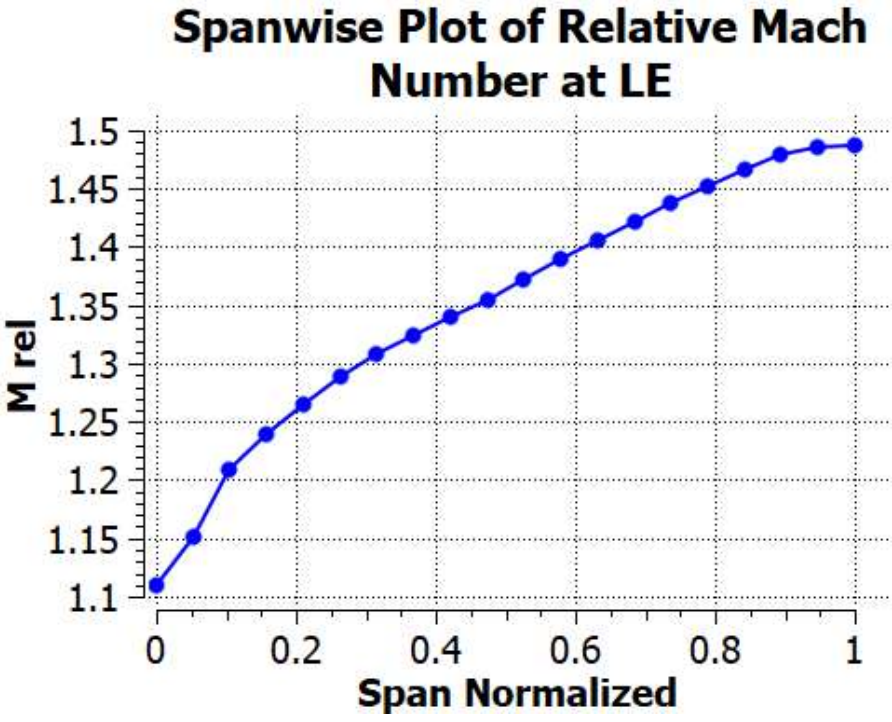


Chart 13. Spanwise Plot of Alpha and Beta at TE

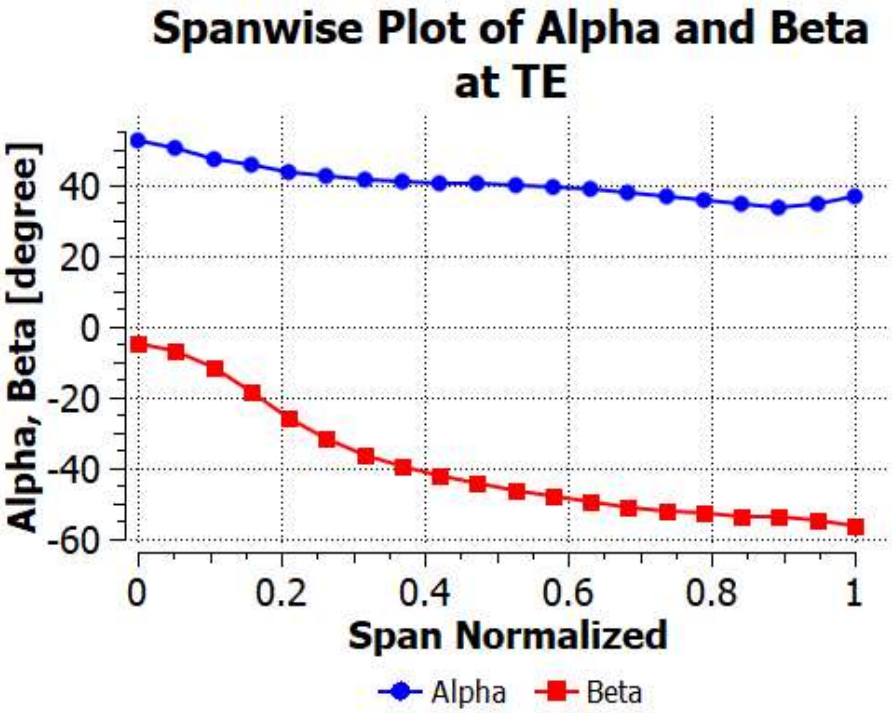


Chart 14. Spanwise Plot of Relative Mach Number at TE

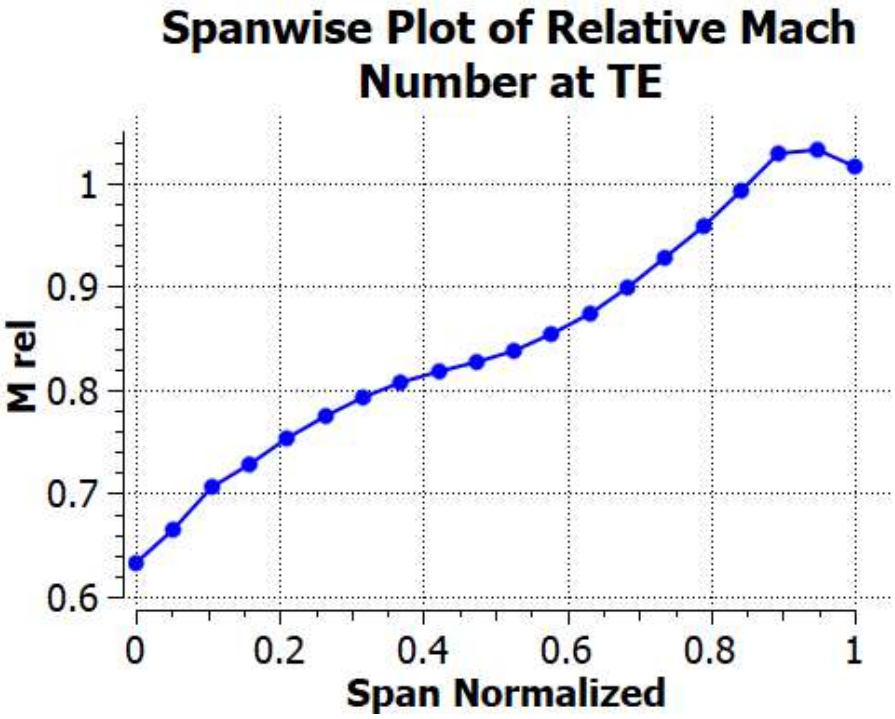


Chart 15. Spanwise Plot of Absolute Mach Number at TE

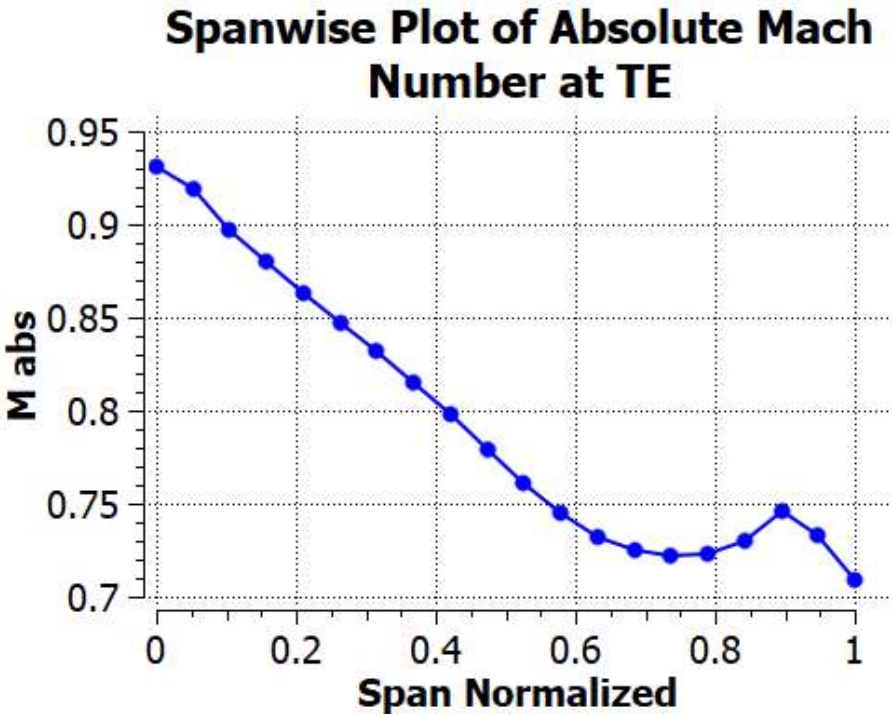
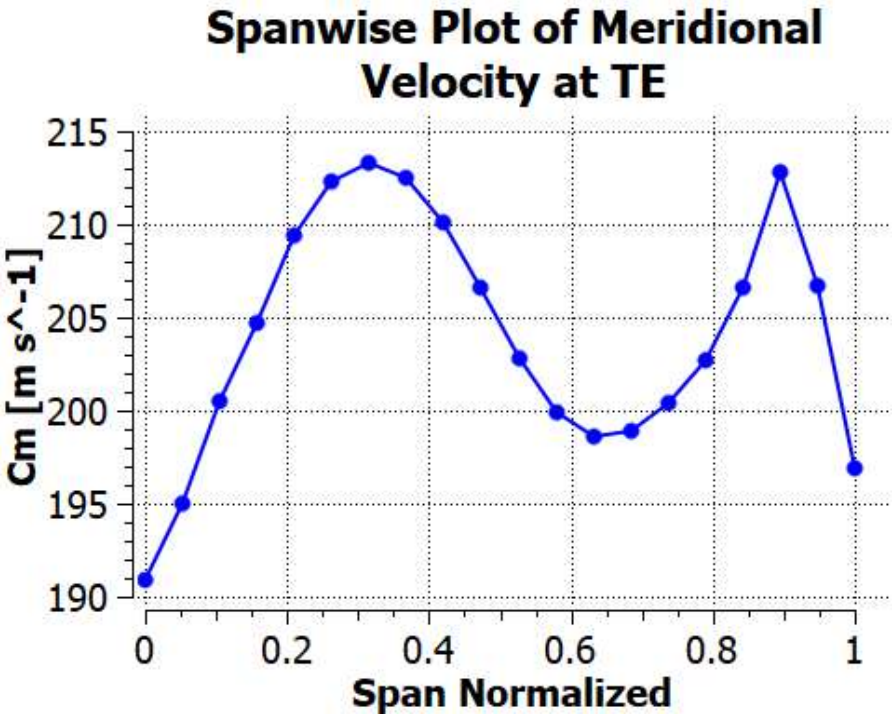


Chart 16. Spanwise Plot of Meridional Velocity at TE



8. Blade Geometry Plots

Figure 3. Isometric 3D View of the Blade, Hub and Shroud

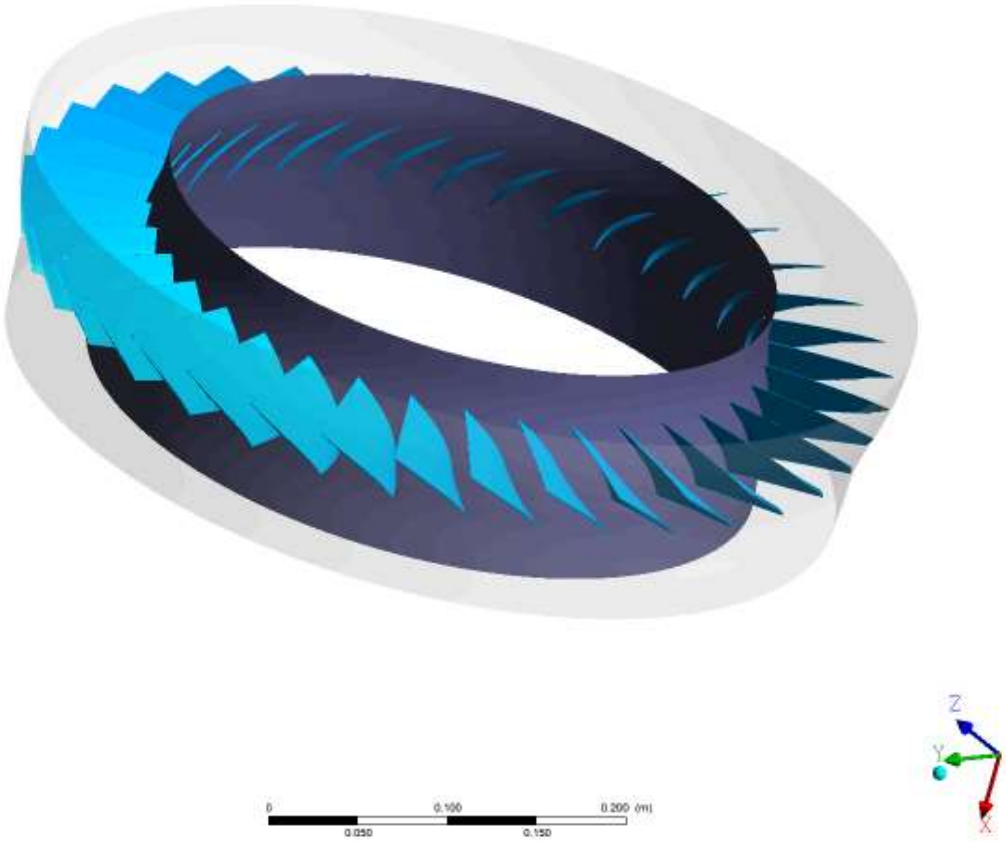
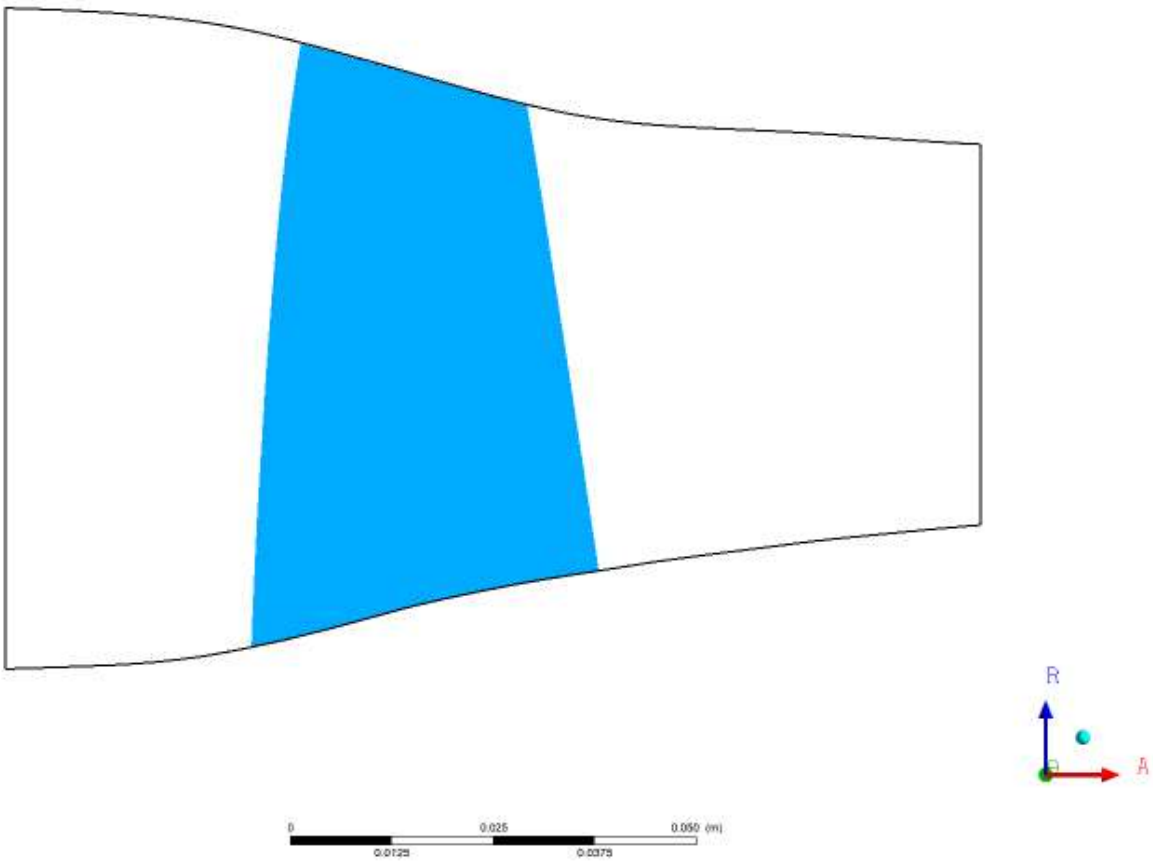
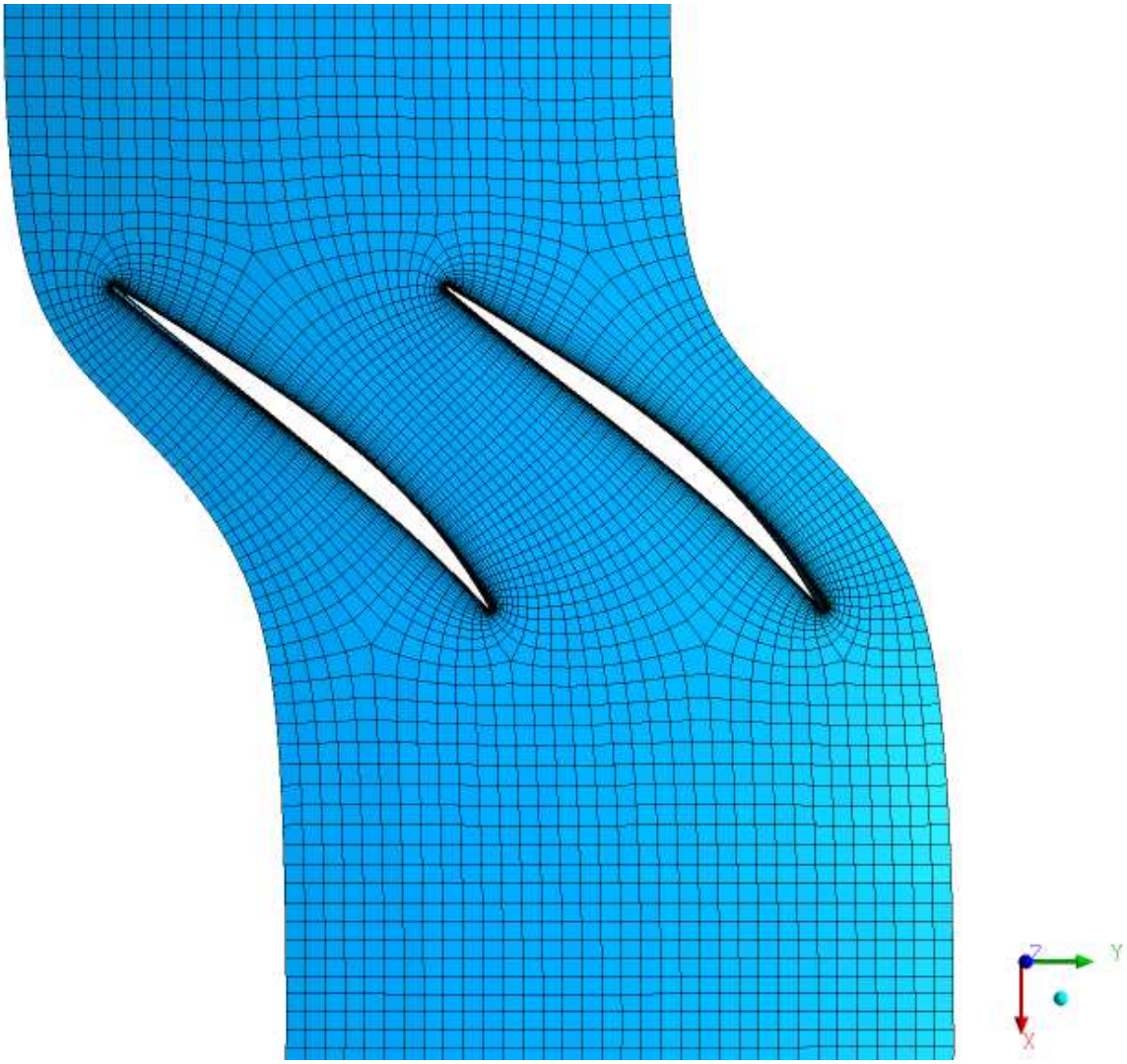


Figure 4. Meridional View of the Blade, Hub and Shroud



9. Blade Mesh Plot

Figure 5. Mesh Elements at 50% Span



10. Blade to Blade Plots

Figure 6. Contour of M rel at 20% Span

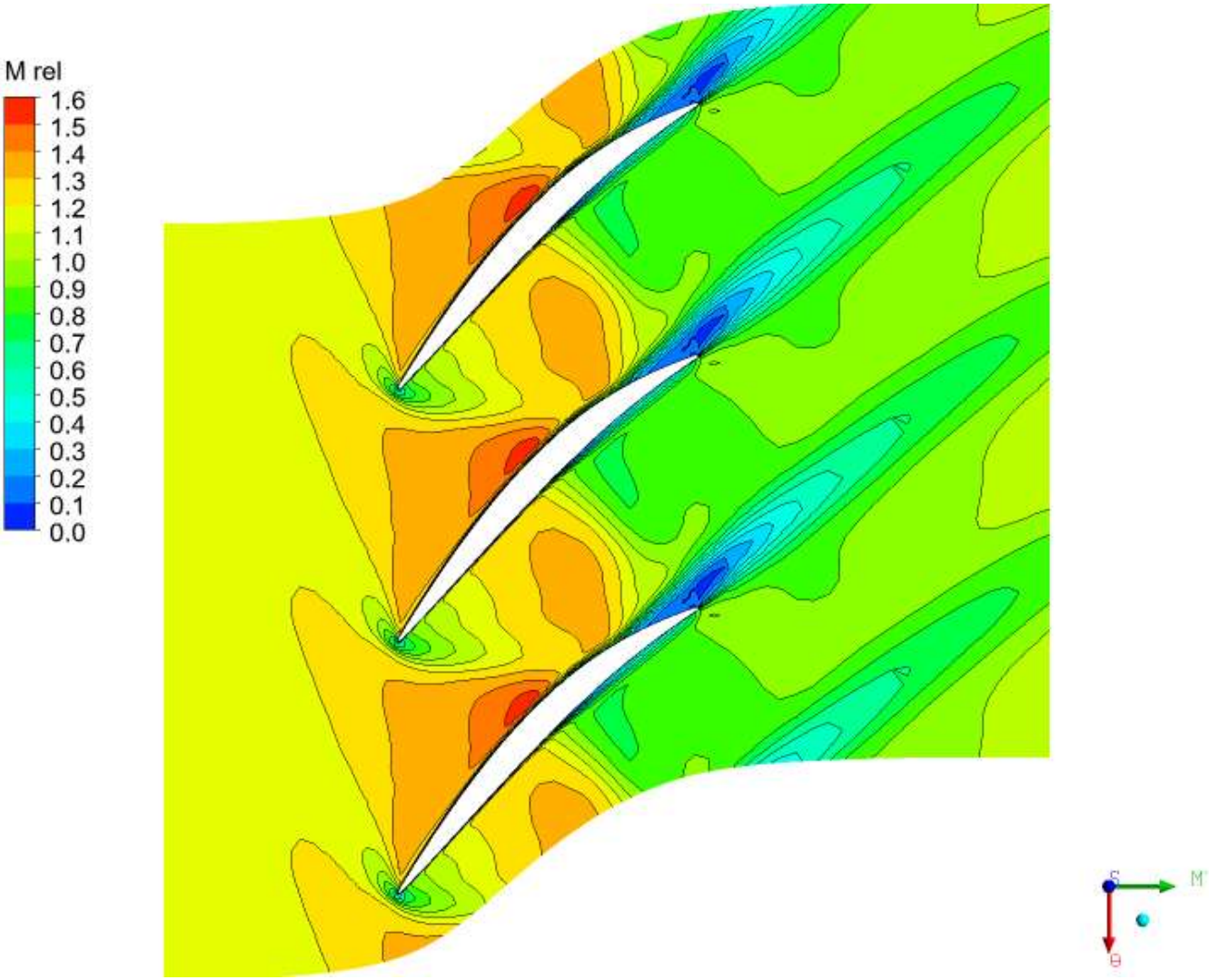


Figure 7. Contour of M rel at 50% Span

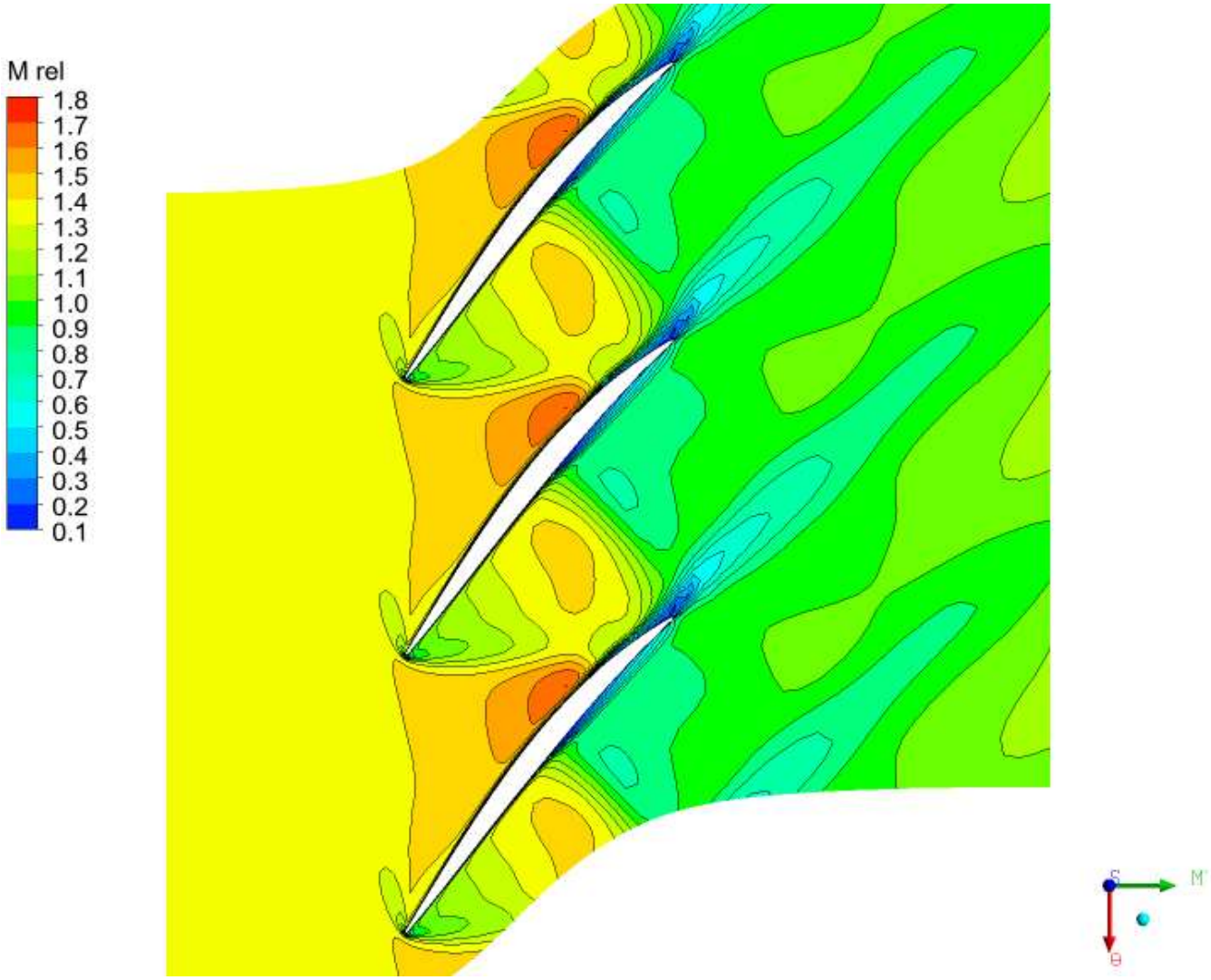


Figure 8. Contour of M rel at 80% Span

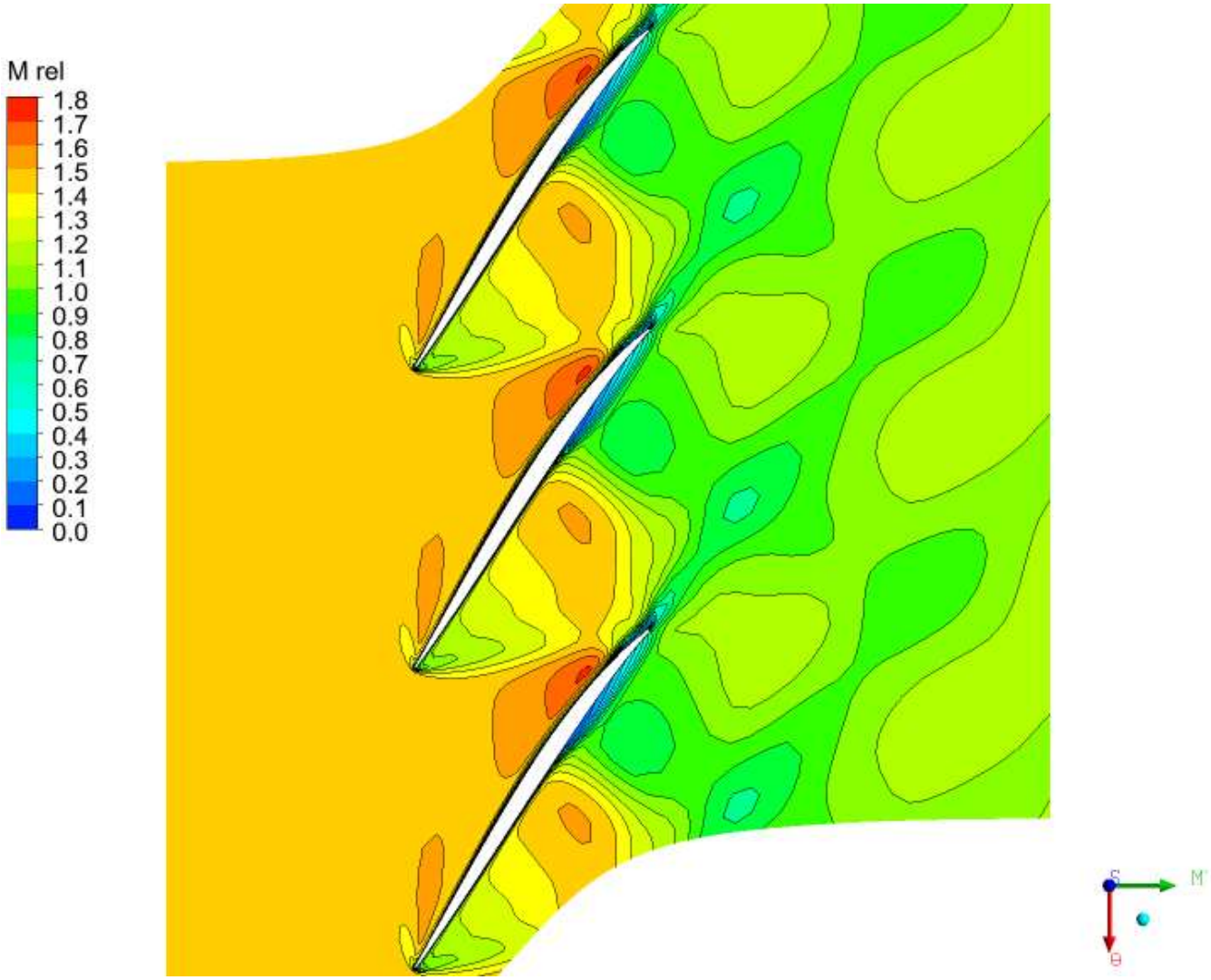


Figure 9. Velocity Vectors at 20% Span

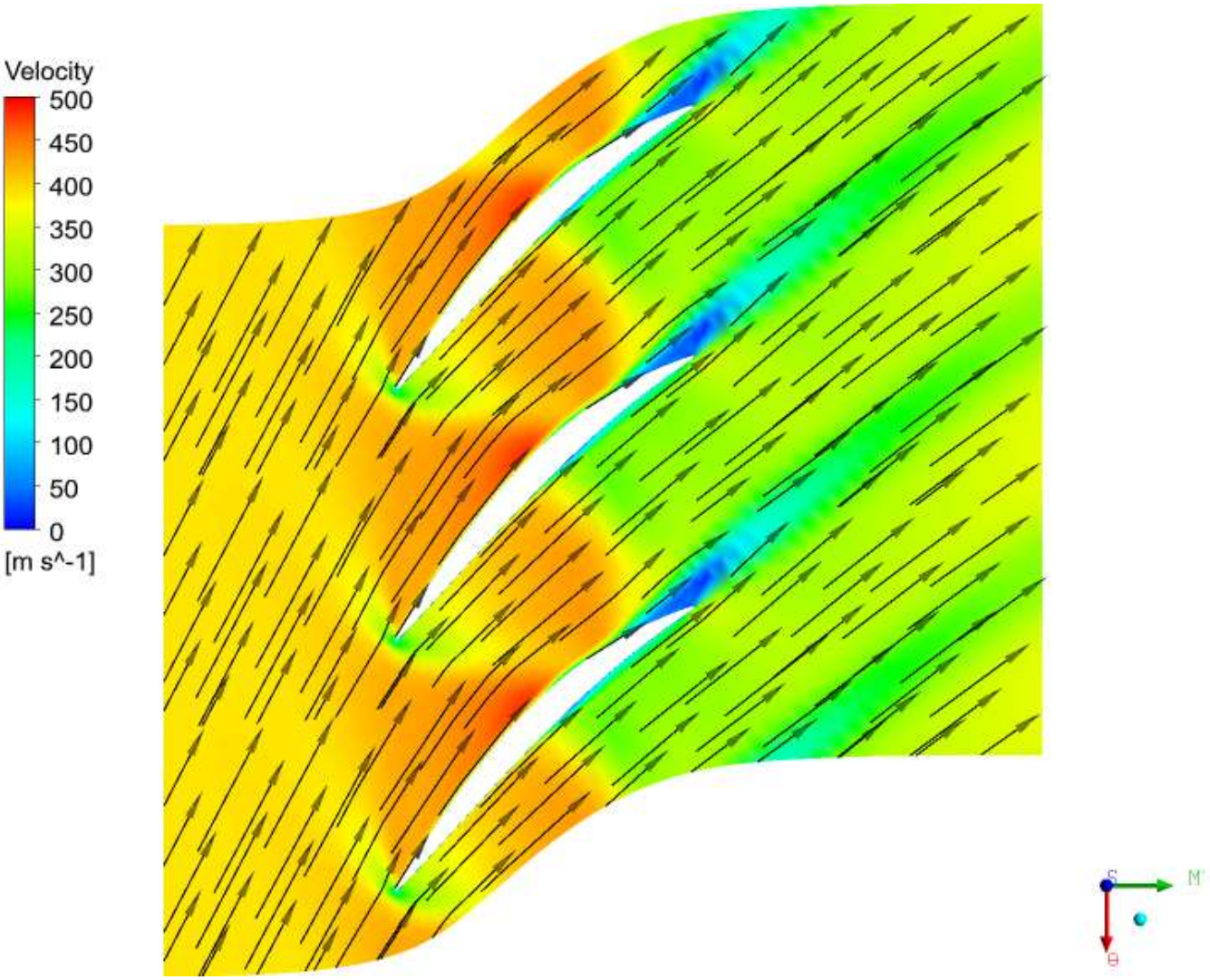


Figure 10. Velocity Vectors at 50% Span

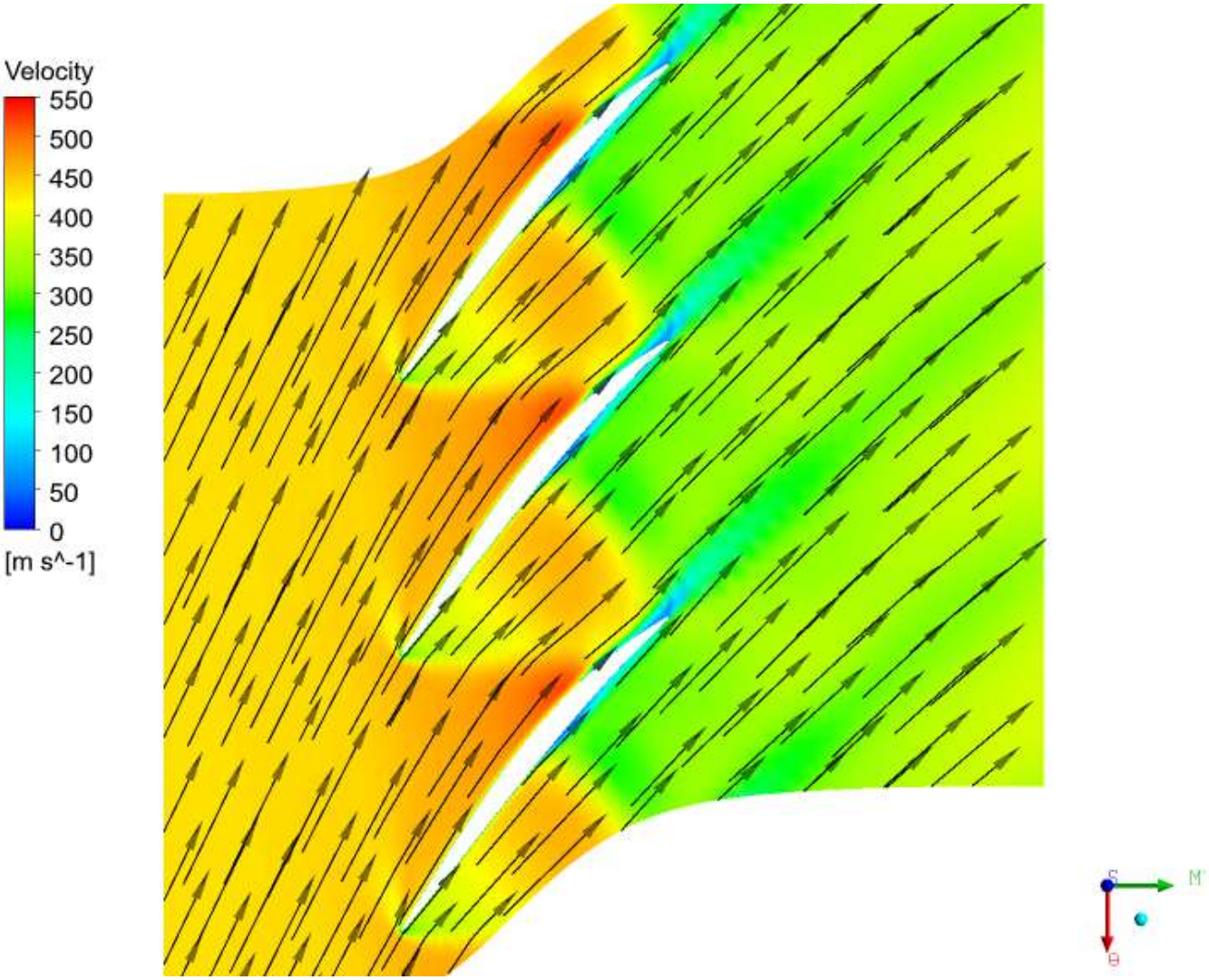


Figure 11. Velocity Vectors at 80% Span

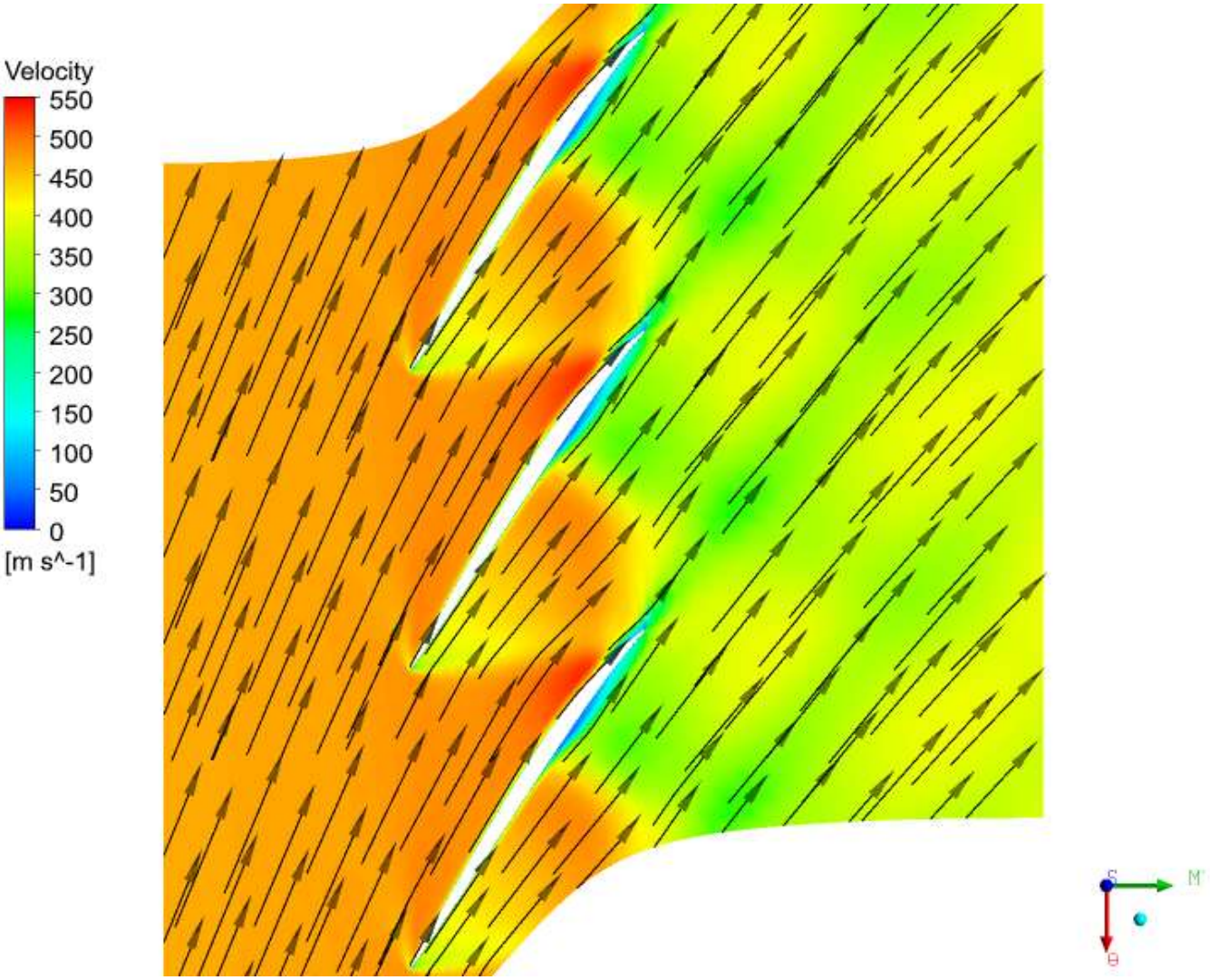


Figure 12. Contour of s at 20% Span

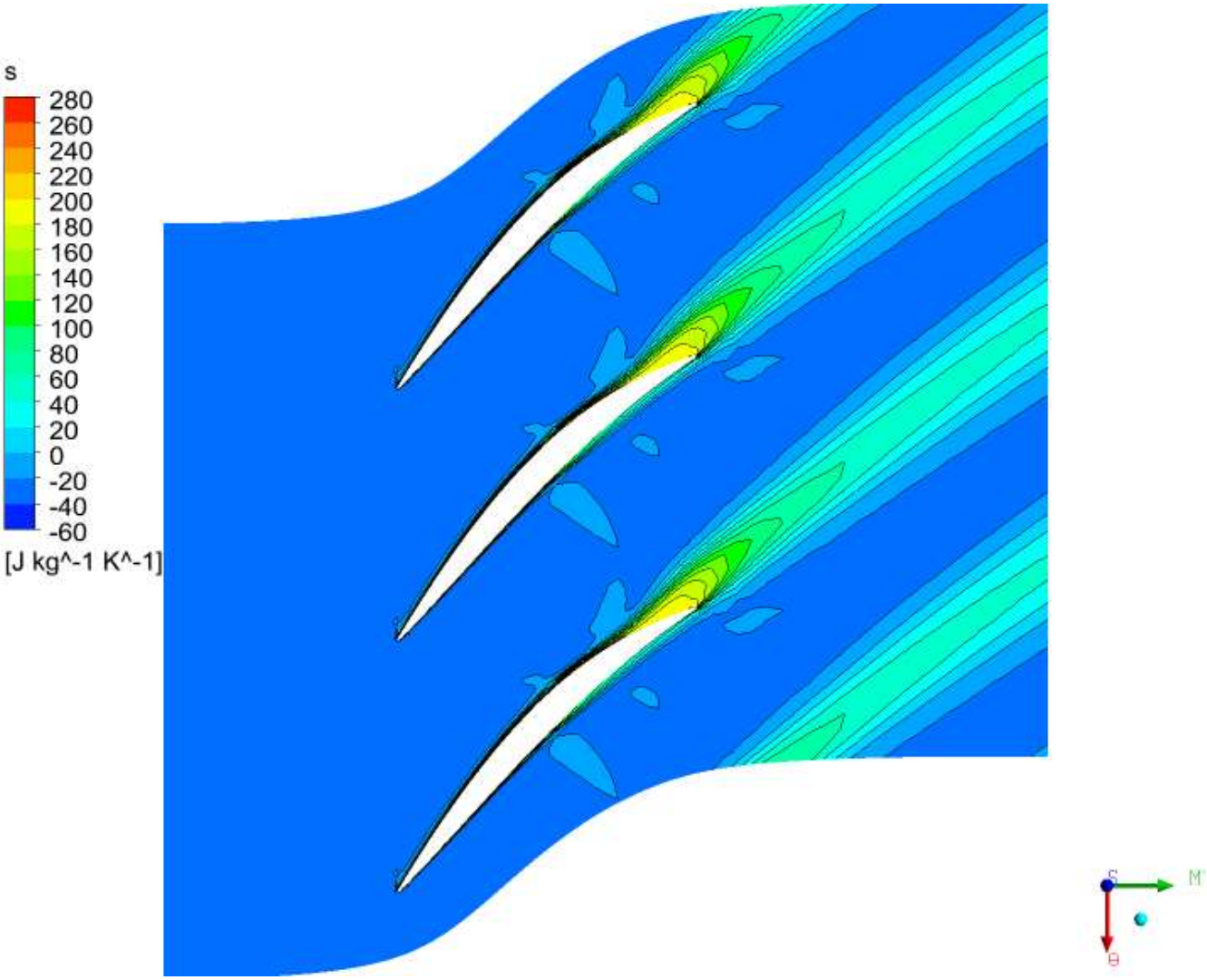


Figure 13. Contour of s at 50% Span

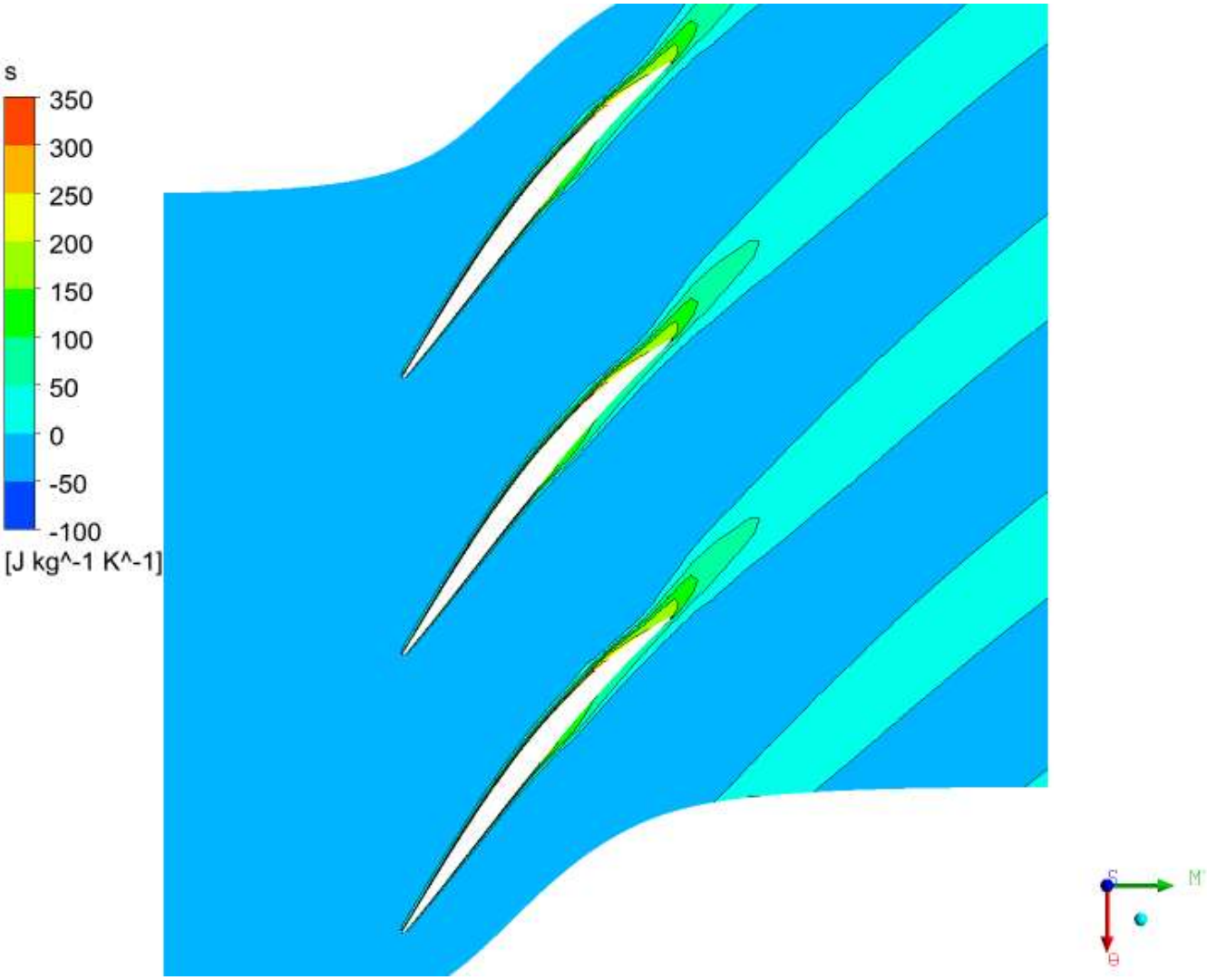
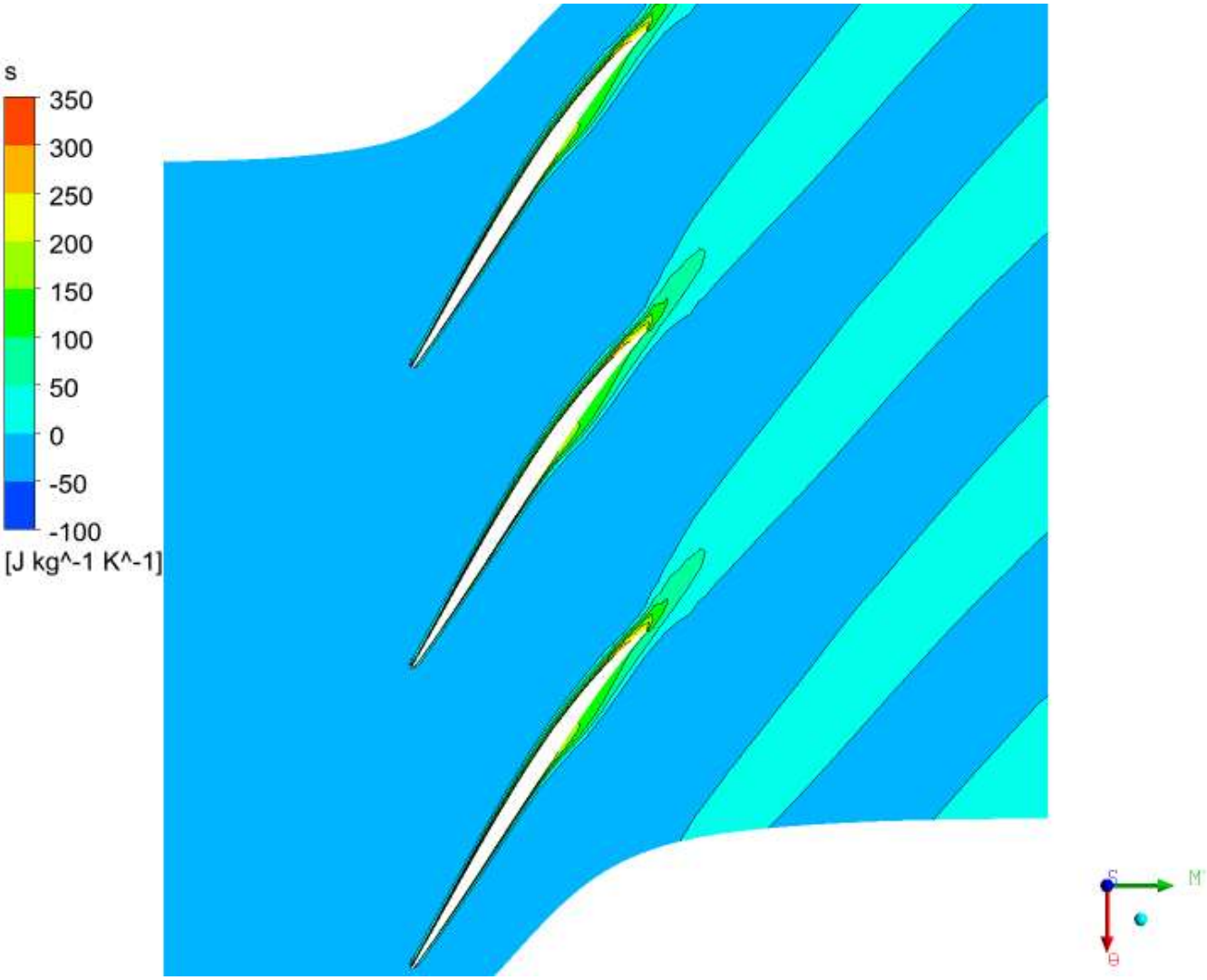


Figure 14. Contour of s at 80% Span



11. Meridional Plots

Figure 15. Contour of Mass Averaged P on Meridional Surface

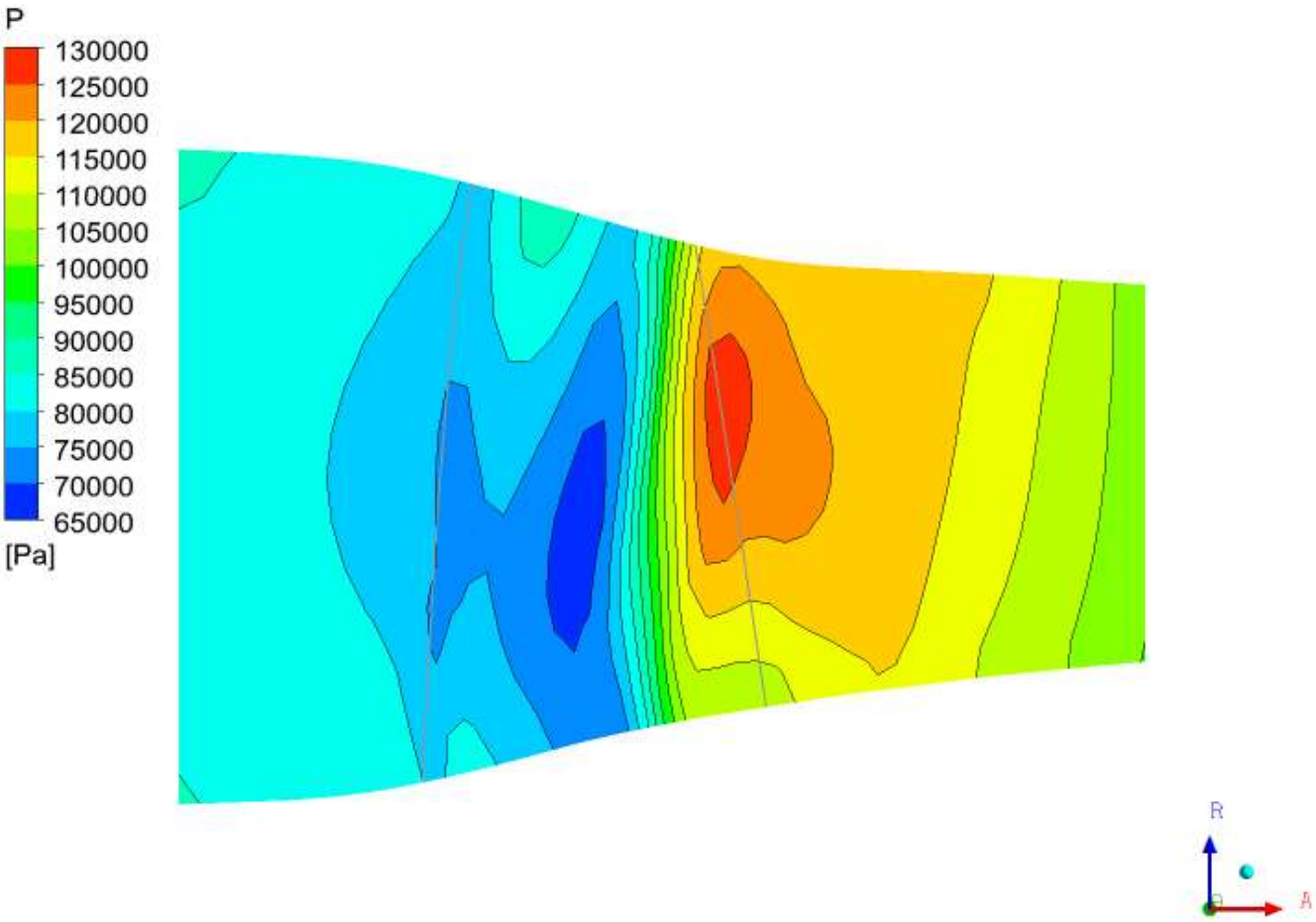


Figure 16. Contour of Mass Averaged M rel on Meridional Surface

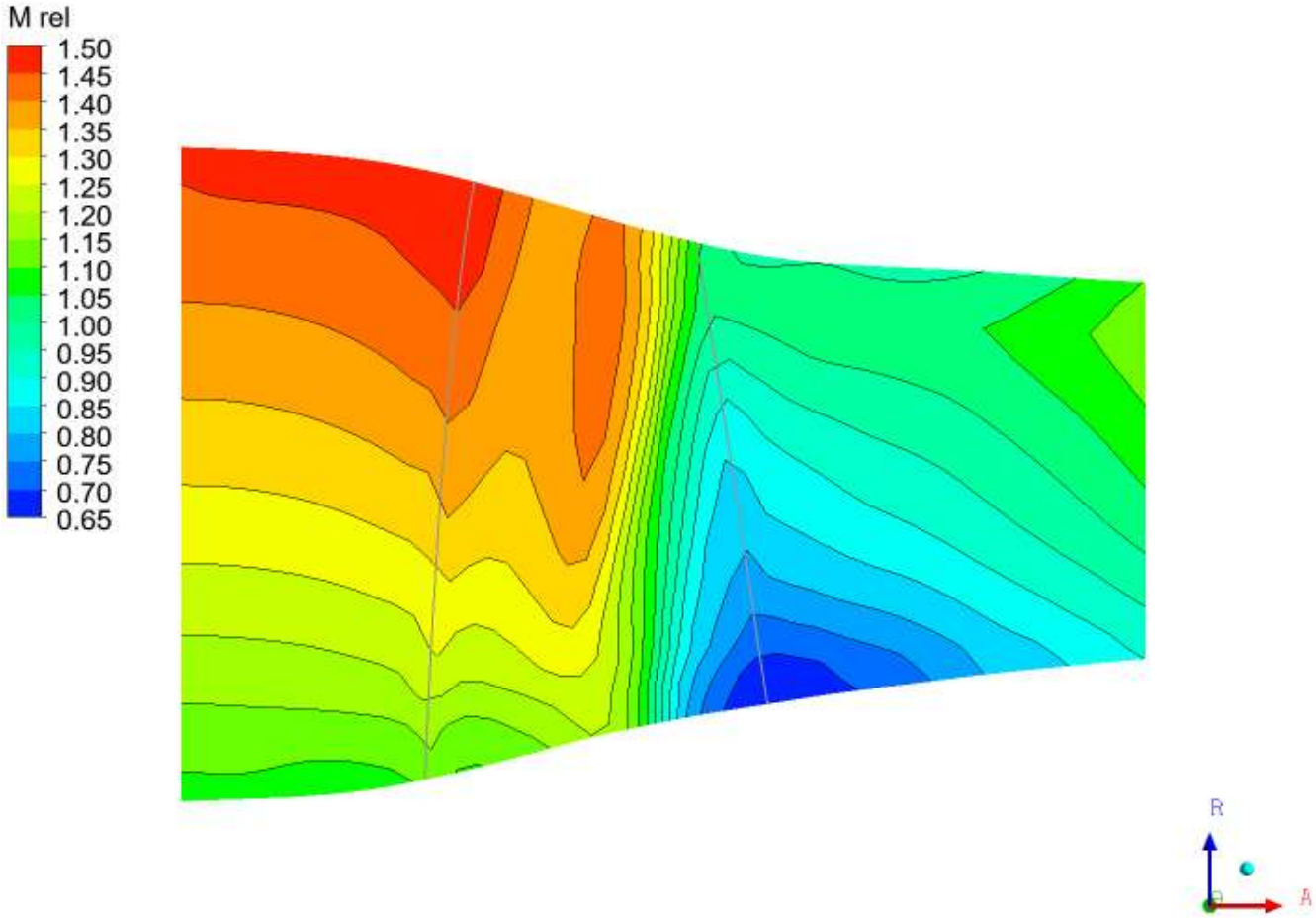
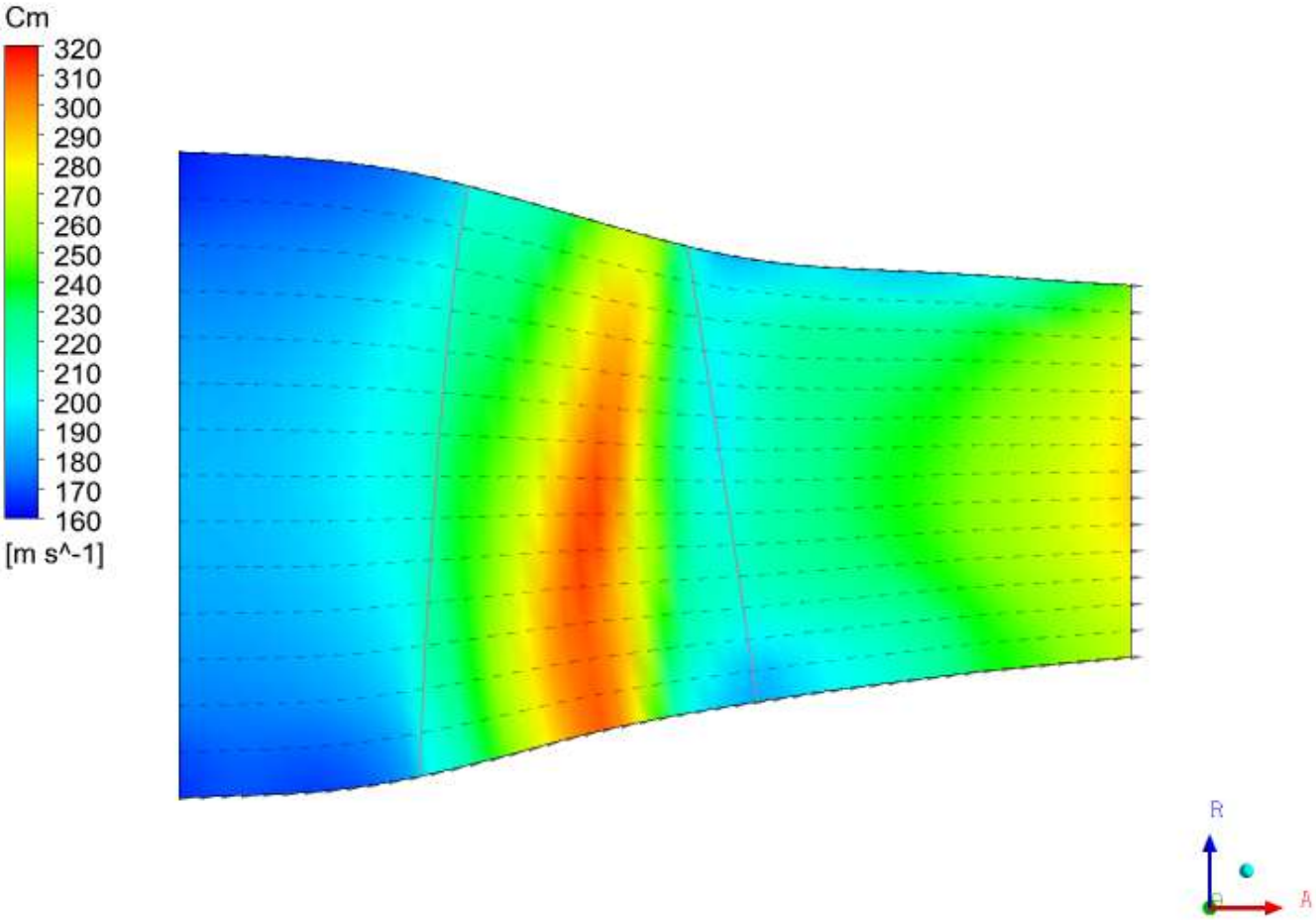


Figure 17. Vector of Area Averaged Cm on Meridional Surface



12. Circumferential Plots

Figure 18. Contour of P at Blade LE

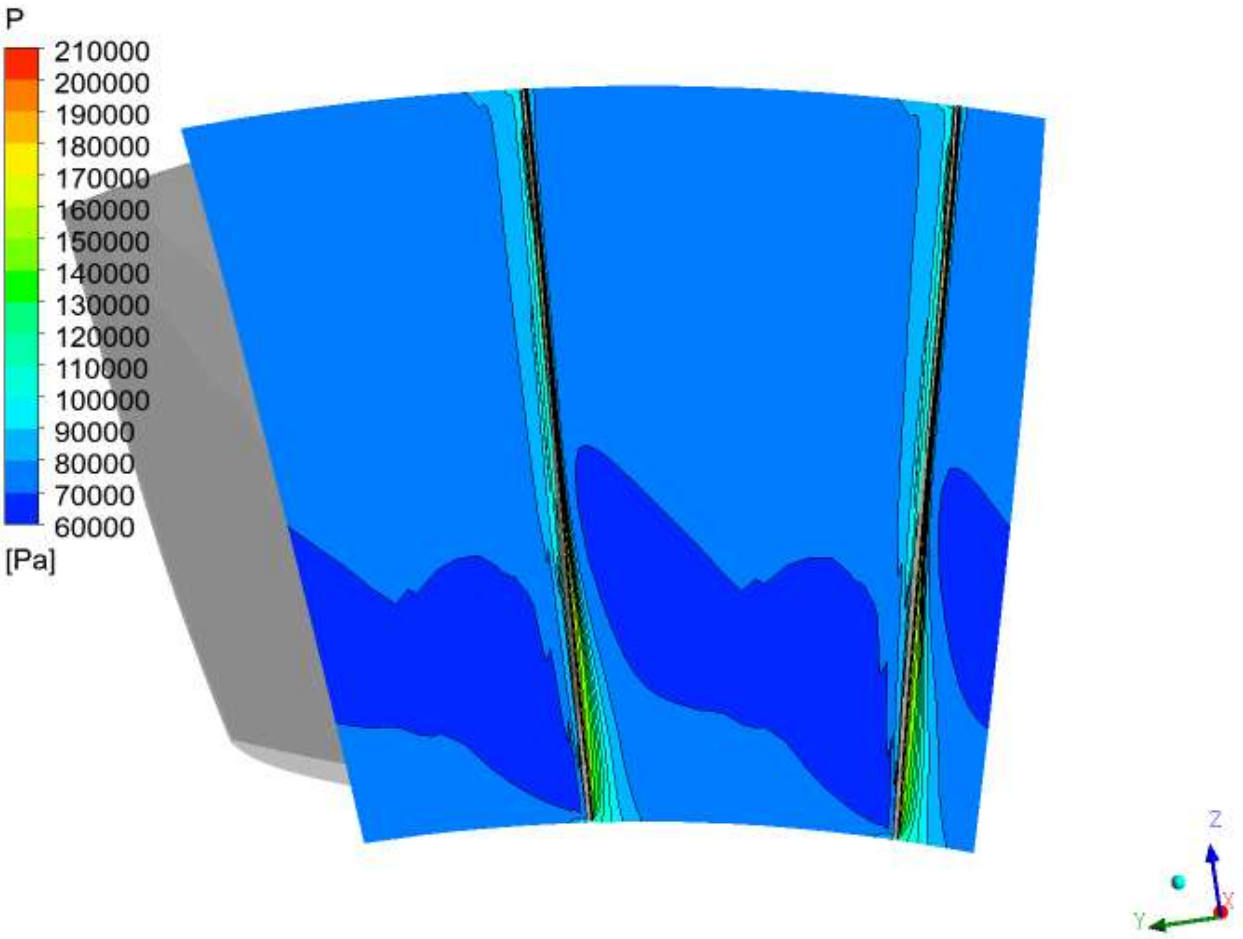


Figure 19. Contour of M rel at Blade LE

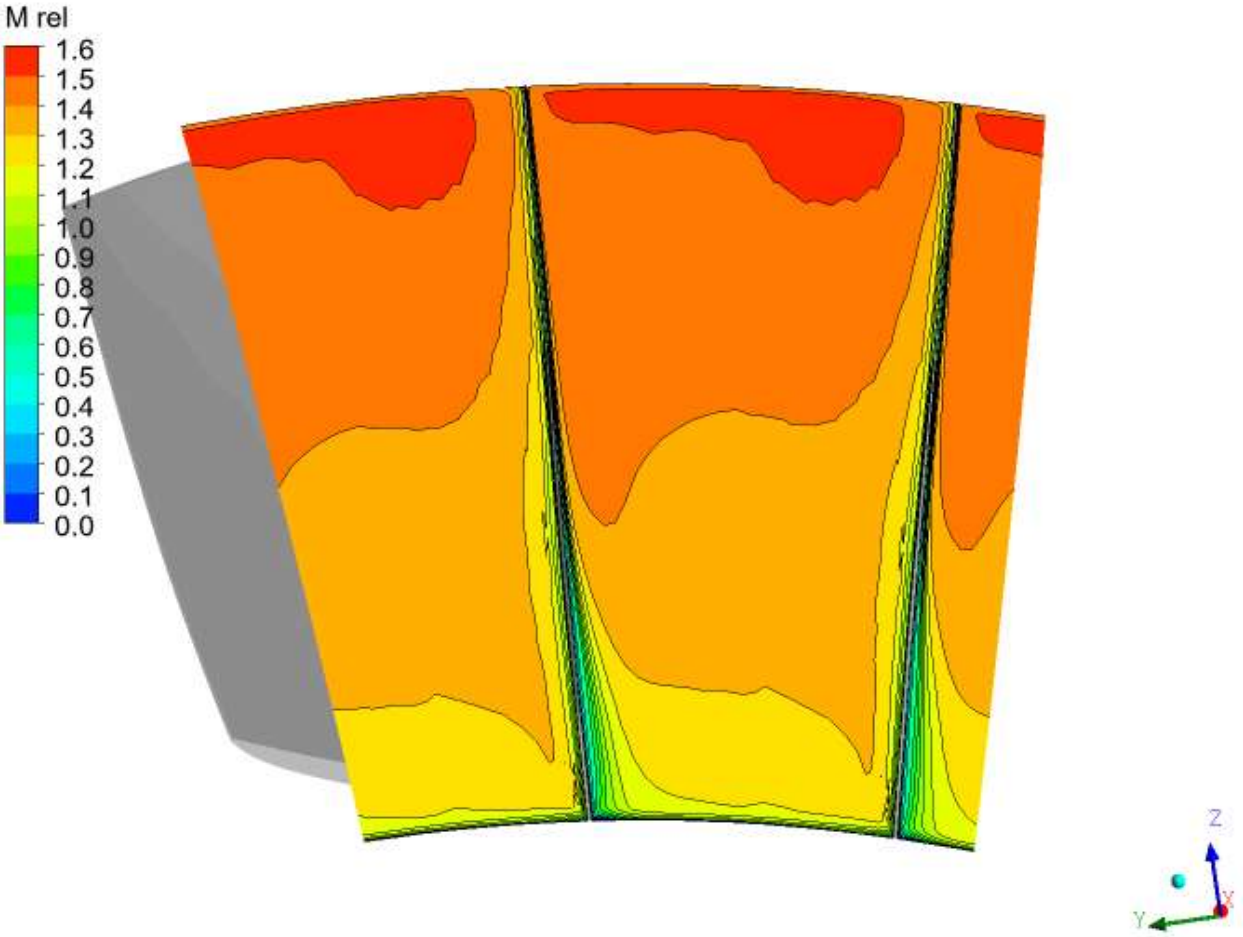


Figure 20. Contour of s at Blade LE

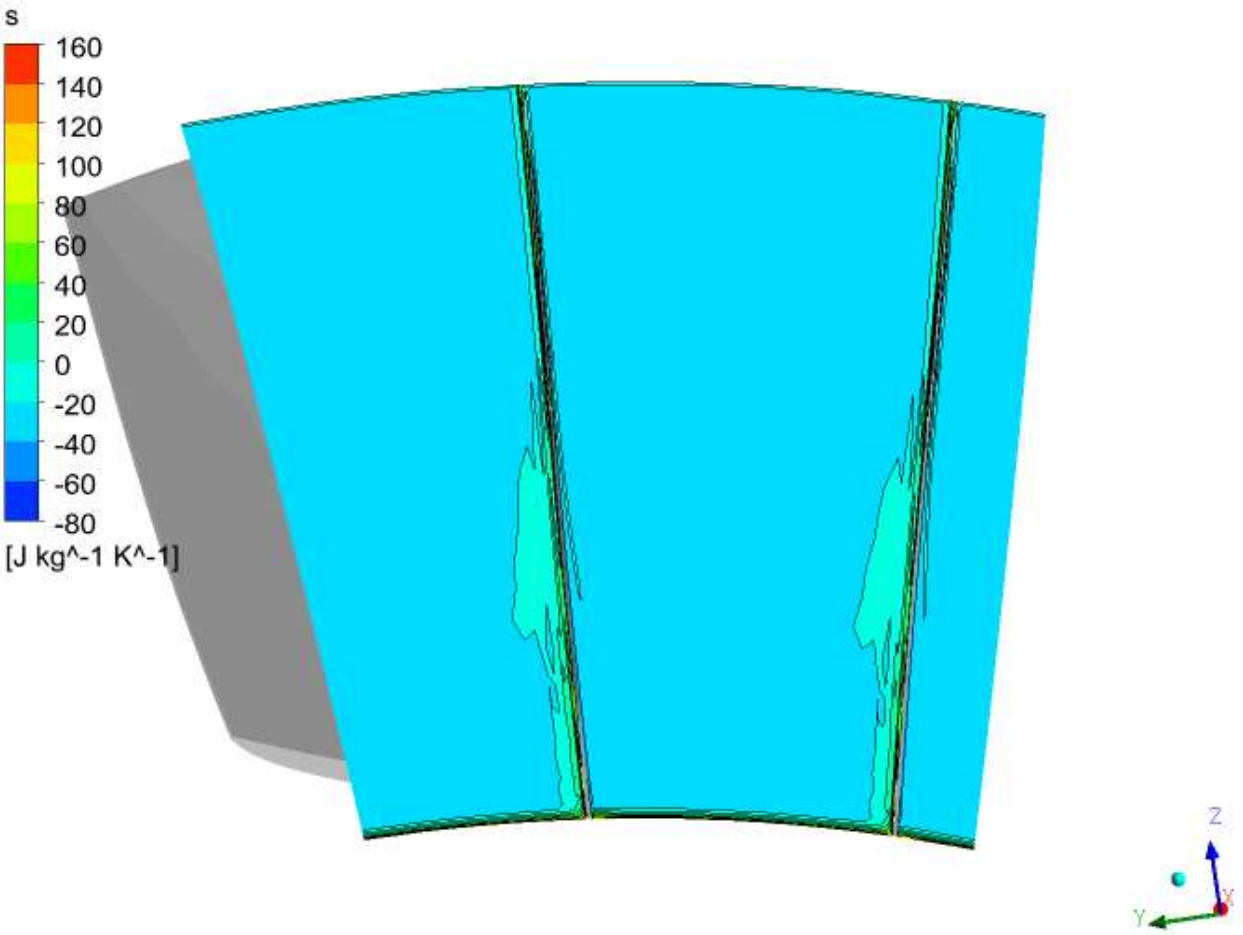


Figure 21. Contour of P at Blade TE

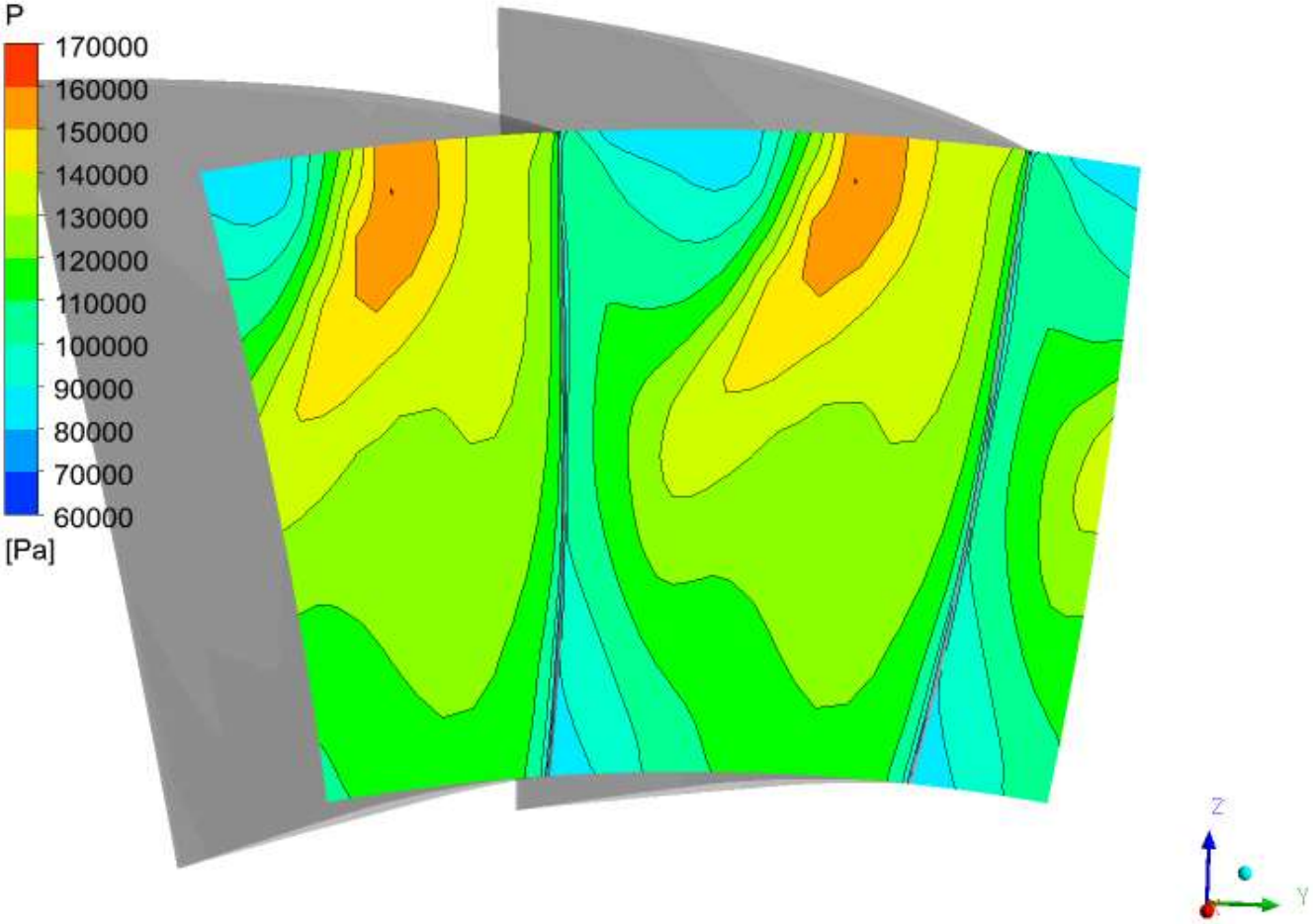


Figure 22. Contour of M rel at Blade TE

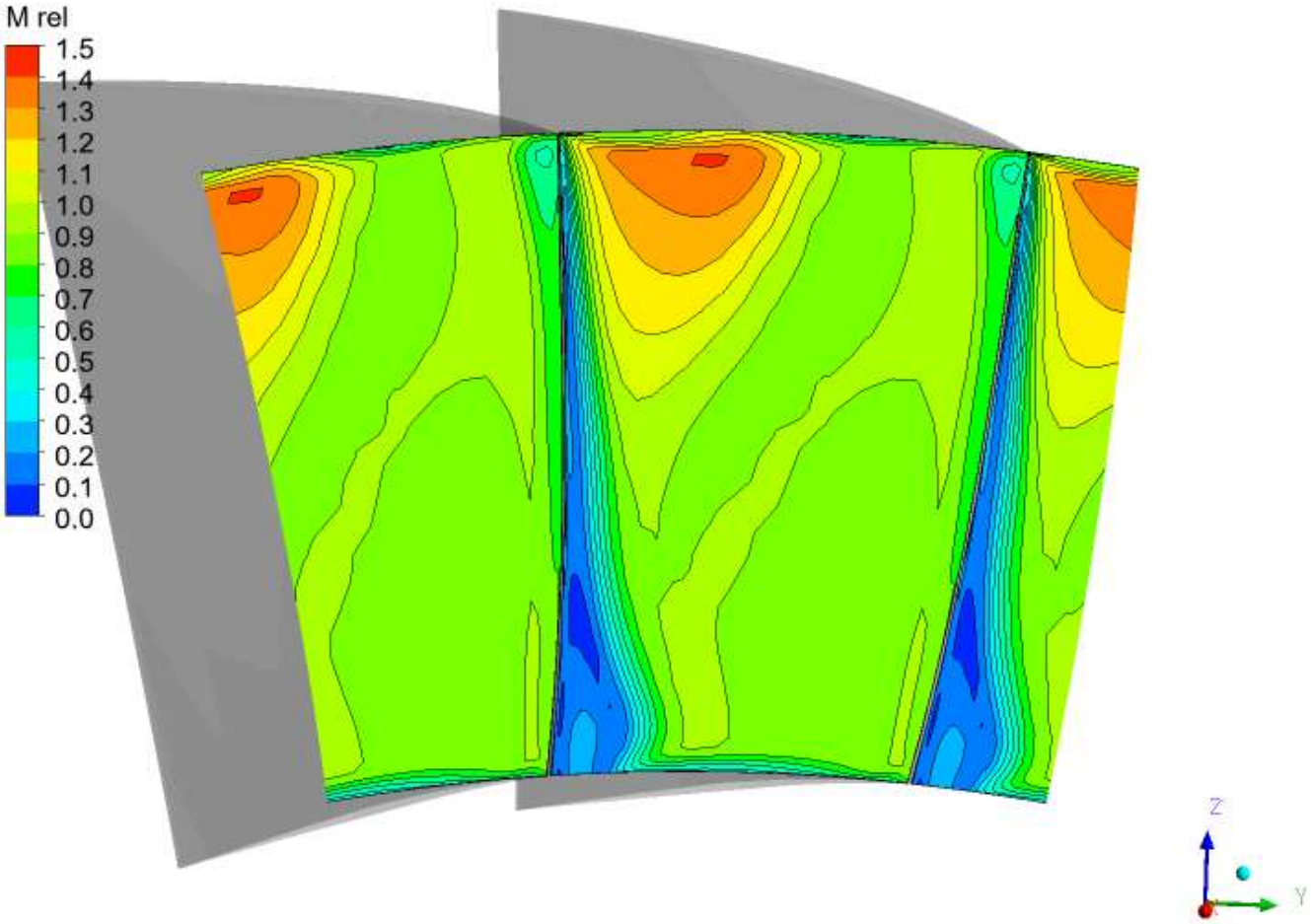
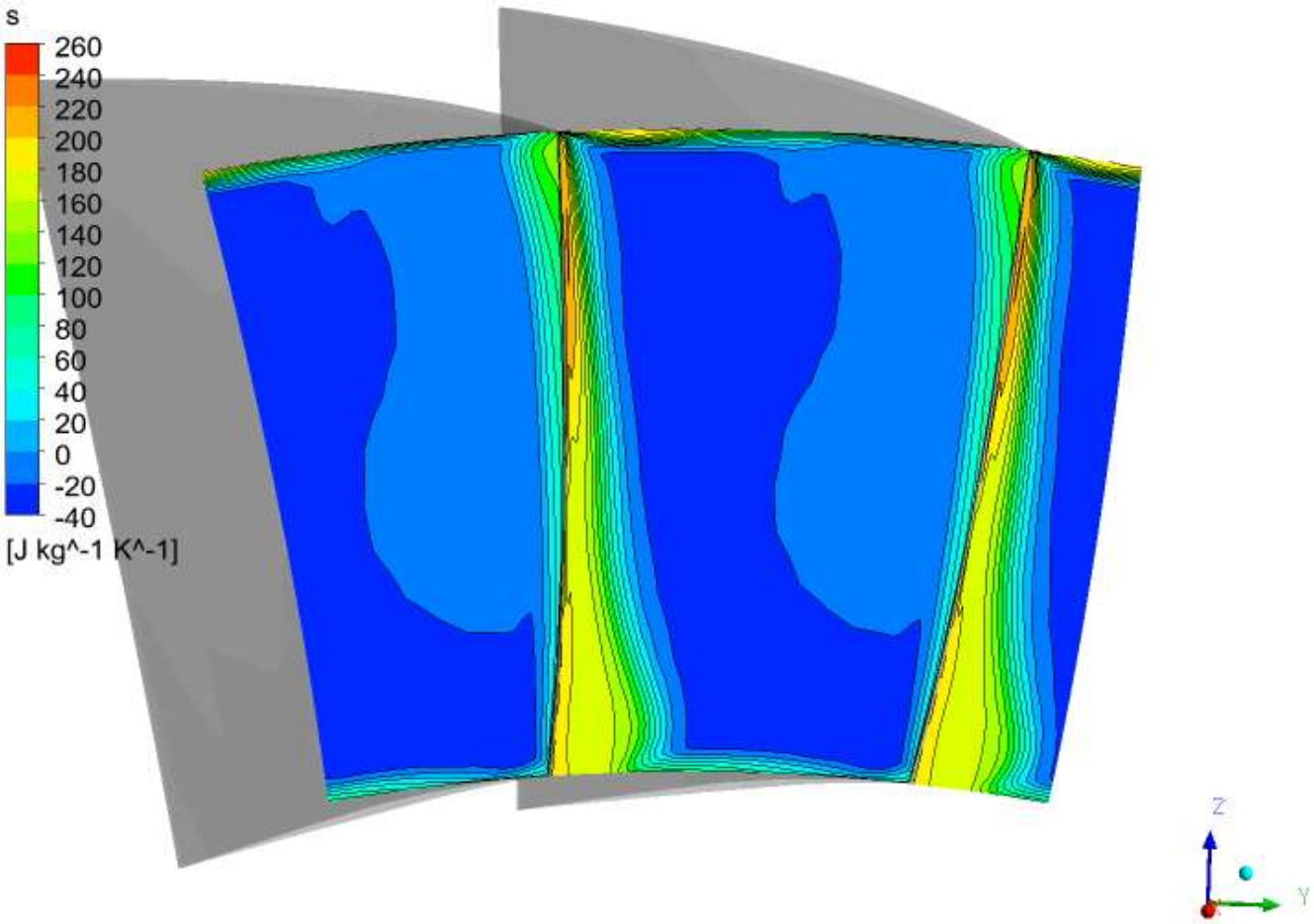


Figure 23. Contour of s at Blade TE



13. Streamline Plot

Figure 24. Velocity Streamlines at Blade TE