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GEOMETRIC-POROSITY MODELING FOR THE NASA DROGUE PARACHUTE

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NASA Orion spacecraft will use a cluster of drogue parachutes at earlier stages of its descent, at Mach number 0.3 to 0.8. The drogue parachute is a ribbon parachute with a nominal diameter of 23 ft. It has 24 gores, 52 ribbons with gaps in between, and also some wider gaps (see Figure 1). Capturing the flow going through all the gaps requires a highly refined mesh. To avoid such meshes in FSI computations, we model the geometric porosity created by the slits based on the "HMGP-FG" [1] (see Figure 1). In this study, to determine the model parameters, we compute the flow with the resolved geometric porosity. The flow is computed with the stabilized space–time finite element formulation [2] of compressible flows. Figure 2 shows the flow through the gaps at an instant during the computation.

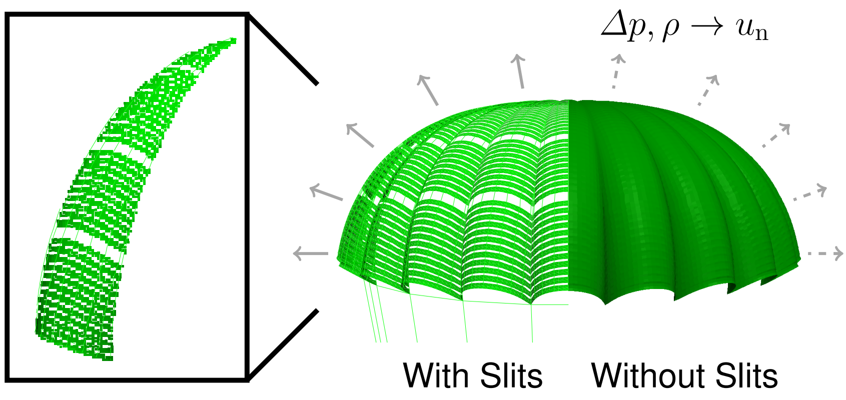

Figure 1. Drogue parachute. Left: a single gore. Right: the parachute surface seen in the fluid mechanics computation with the resolved (with slits) and modeled (without silts) geometric porosities. The geometric-porosity modeling is based on obtaining an expression for the normal component of the velocity in term of the pressure difference across the parachute, density, and the model parameters.

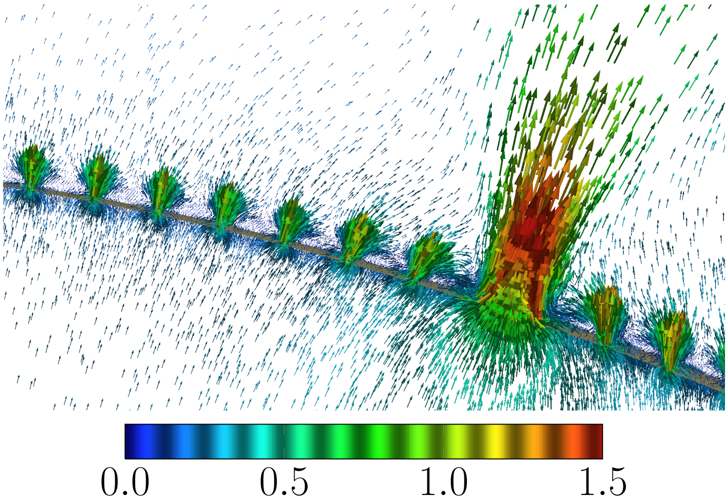

Figure 2. Compressible-flow computation with the resolved geometric porosity. Flow through the gaps at an instant during the computation. The velocity vectors are normalized by the free-stream velocity and colored by the magnitude of the normalized velocity.

REFERENCES

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