

**Takizawa, Kenji; Henicke, Bradley; Puntel, Anthony; Kostov, Nikolay; Tezduyar, Tayfun E.** **Space-time techniques for computational aerodynamics modeling of flapping wings of an actual locust.** (English) Zbl 1286.76179  
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**Summary:** We present the special space-time computational techniques we have introduced recently for computational aerodynamics modeling of flapping wings of an actual locust. These techniques have been designed to be used with the deforming-spatial-domain/stabilized space-time (DSD/SST) formulation, which is the core computational technique. The DSD/SST formulation was developed for flow problems with moving interfaces and was elevated to newer versions over the years, including the space-time version of the residual-based variational multiscale (VMS) method, which is called “DSD/SST-VMST” and used in the computations reported here. The special space-time techniques are based on using, in the space-time flow computations, NURBS basis functions for the temporal representation of the motion and deformation of the locust wings. The motion and deformation data is extracted from the high-speed, multi-camera video recordings of a locust in a wind tunnel. In addition, temporal NURBS basis functions are used in representation of the motion and deformation of the volume meshes computed and also in remeshing. These ingredients provide an accurate and efficient way of dealing with the wind tunnel data and the mesh. The computations demonstrate the effectiveness of the core and special space-time techniques in modeling the aerodynamics of flapping wings, with the wing motion and deformation coming from an actual locust.

**MSC:**

**76Z10** Biopropulsion in water and in air  
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**Keywords:**

space-time techniques; NURBS; mesh moving techniques; remeshing; computational aerodynamics; flapping wings; locust

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