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PERFORMANCE EVALUATION OF HOVERING FLIGHT OF DEFORMABLE FLAPPING WING USING PARTITIONED FSI ANALYSIS

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Inch-size flying robots, so-called MAVs have been researched and developed in worldwide. These robots are expected to play an important role in environmental monitoring, life-saving activities at narrow locations with complex obstacles and so on. However in such an inch-size world, fixed wing airplanes or helicopters cannot demonstrate sufficient flight performance because of viscosity. The flapping flight of birds and insects can be considered as one of optimal flight mechanisms in their size, which they have obtained through their long-time evolution. Actually they are known to have excellent flight performance such as VTOL ability, high energy efficiency, rapid turning ability and so on [1-3]. Among various types of FSI simulations of flapping wing [4-10], we have been developing a parallel coupling method using partitioned coupling algorithms [5,6,11,12]. In FSI analyses within the framework of partitioned coupling algorithms, we employ a parallel solid solver named ADVENTURE_Solid [12-14], a parallel LES-based flow solver named FrontFlow/blue [15, 16], and a parallel coupling tool named ADVENTURE_Coupler for parallel data exchange and execution of partitioned coupling algorithms [12]. In this presentation, we apply the developed FSI method to simulate hovering flight of deformable flapping square plate. By parametrically changing elastic parameters of the deformable plate, we perform a number of FSI simulations. We then discuss the relationship between flight performance and elastic properties of the flapping plate.

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