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Bio-inspired flows in unsteady environments. Part III: mean flow shear MEILIN YU, University of Maryland, Baltimore County, Z.J. WANG, SAEED FAROKHI, University of Kansas — Autonomous underwater vehicles (AUVs) and unmanned aerial vehicles (UAVs) usually need to carry out tasks in unstructured and dynamic flow environments. This poses a number of challenges that cannot easily be addressed by approaches developed for highly controlled environments, such as uniform flows frequently used in experiments and numerical simulation This work studies the impact of mean flow shear on the performance of flapping wings/fins. A hyperbolic tangent mean flow shear profile is superposed onto the uniform freestream to generate a shear flow A high-order accurate spectral difference flow solver with moving/deforming body-fitted unstructured meshes is used to perform the numerical simulation, and dynamic mode decomposition is applied to analyze coherent flow structures. We find that flapping motion can significantly promote unsteady lift generation in mean flow shear; the stronger the shear is, the larger the lift is. At the same time, the lift coefficient is much larger than that predicted by the Kutta-Joukowski theory under the same flow conditions. Thrust generation is almost not affected by the mean flow shear.

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