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Volumetric visualization of the near and far field wake in flapping wings[1] YUN LIU, BO CHENG, XINYAN DENG, School of Mechanical Engineering, Purdue Unversity, BIO-ROBOTICS LAB TEAM — The flapping wings of flying animals create complex vortex wake structure, understanding its spatial and temporal distribution is fundamental to animal flight theory. In this study, we applied the volumetric 3-component velocimetry to capture both the near- and far-field flow generated by a pair of mechanical flapping wings. For the first time, the complete three-dimensional wake structure and its evolution throughout a wing stroke were quantified and presented. The general vortex wake structure maintains a quite consistent form: vortex rings in the near-field and two shear layers in the far-field. In specific, vortex rings shed periodically from the wings and are linked to each other in successive strokes. In the far-field, the shed vortex rings evolve into two parallel shear layers with dominant vorticity convected from tip and root vortices. The shear layers are nearly stationary in space compared to the periodic vortex rings shed in the near field. In addition, downwash passes through the centers of the vortex rings and extends downward between the two shear layers.

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