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Short-Wave Instability for Low Reynolds Number Flow over an Inclined Spinning Circular Disk at High Tip-Speed Ratios[1] MARCUS LEE, TIM COLONIUS, BEVERLEY MCKEON, California Institute of Technology — Spin stabilization motivates the study of spinning circular disks for potential application to micro air vehicle design for increased flight robustness. We use a three-dimensional immersed boundary lattice Green's function method (IBLGF) to simulate flow over a spinning circular disk at angle of attack for Reynolds numbers of $O(10^2)$ and tip-speed ratios up to 3. A short-wave instability emerges in the advancing tip vortex for tip-speed ratios greater than about 1.9. This instability is not present in the non-spinning case and can exhibit frequency lock-in behavior either with the rotation of the disk or with the vortex-shedding instability. Spectral proper orthogonal decomposition (SPOD) of the flow field isolates high-energy modes that help to characterize these instabilities and their coupling.

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