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Mathematical models for exotic wakes SAIKAT BASU, Okinawa Institute of Science and Technology, Japan, MARK STREMLER, Virginia Polytechnic Institute and State University, U.S.A. — Vortex wakes are a common occurrence in the environment around us; the most famous example being the von Kármán vortex street with two vortices being shed by the bluff body in each cycle. However, frequently there can be many other more exotic wake configurations with different vortex arrangements, based on the flow parameters and the bluff body dimensions and/or its oscillation characteristics. Some examples include wakes with periodic shedding of three vortices ('P+S' mode) and four vortices (symmetric '2P' mode, staggered '2P' mode, '2C' mode). We present mathematical models for such wakes assuming two-dimensional potential flows with embedded point vortices. The spatial alignment of the vortices is inspired by the experimentally observed wakes. The idealized system follows a Hamiltonian formalism. Model-based analysis reveals a rich dynamics pertaining to the relative vortex motion in the mid-wake region. Downstream evolution of the vortices, as predicted from the model results, also show good correspondence with wake-shedding experiments performed on flowing soap films.

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