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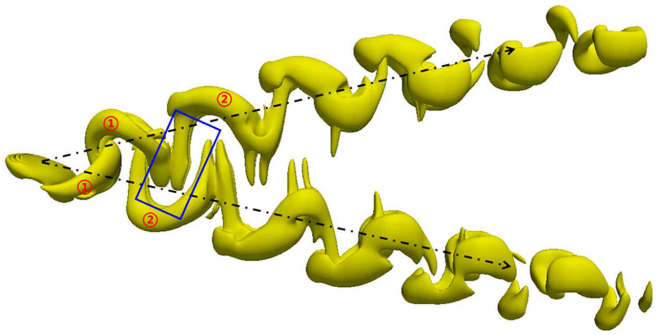
The mechanical benefits of birds schooling together encourages unique, energy-efficient, aeronautical designs.



Throughout aeronautical history, Birds have inspired the design of aircraft, largely because evolution has made most *Aves* well-equipped for flight in various environmental conditions. One flying technique, known as "schooling," helps birds conserve energy while flying.

Physicists Zhang et al. were inspired to study the aerodynamic physical mechanisms behind this biological phenomenon. In this study, they present numerical calculations on the efficiency of schooling, which provide theoretical support for future formation-style bionic-inspired designs.

The authors use in-house numerical methods verified by Navier-Stokes results to study flow over a single flapping wing and the flapping of multiple wings in a diamond school formation at different flapping frequencies. They examined how schooling affected propulsion and energy consumption.

"Our numerical results show that individuals in the school at very low flapping frequencies will produce the same thrust performance as a single wing at higher flapping frequencies," said author Gang Chen. "The interaction between individuals in the school enhanced the performance of a wing."

By studying different individual flapping frequencies within the schooling formation, the authors identified the optimal frequency for energy conservation and maximum efficient propulsion.

The authors believe that the proven benefits of clustering behavior, such as increased propulsion efficiency and reduced energy consumption, will have applications in the autonomous formations of micro air vehicles and micro underwater vehicles. In the future, they intend on researching fluid structure interaction and using a mechanical wing shape rather than a biological one in flight formations.

Source: "Effects of the flapping frequency on the thrust performance for three-dimensional bionic multi-wings in a schooling," by Yang Zhang, Jiakun Han, and Gang Chen, *Physics of Fluids* (2019). The article can be accessed at https://doi.org/10.1063/1.5127540.