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Dimensionality and behavior of swimming Zebrafish: “The Eigen-Fish” KIRAN GIRDHAR, MARTIN GRUEBELE, YANN CHEMLA, University of Illinois at Urbana Champaign — How simple is the underlying control mechanism for the complex locomotion of vertebrates? To answer this question, we study the swimming behavior of zebrafish larvae. A dimensionality reduction method (singular value decomposition), in analogy to previous studies of worms, is used to analyze swimming movies of fish. That way, the animals can directly provide us with a minimal set of shapes to describe their motion, rather than us imposing arbitrary coordinates. We show that two low dimensional attractors (an ellipse and a distorted ellipse) embedded in a threedimensional space of motion coordinates are sufficient to describe $> 95\%$ of the locomotion. We also show that scoots and R-turns, previously thought to be independent behaviors based on qualitative studies, are in fact just extremes of a continuous family of motions bounded by the two attractors.

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