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Cetacean Swimming with Prosthetic Limbs<sup>1</sup> AYODEJI BODE-OKE, YAN REN, HAIBO DONG, University of Virginia, FRANK FISH, West Chester University — During entanglement in fishing gear, dolphins can suffer abrasions and amputations of flukes and fins. As a result, if the dolphin survives the ordeal, swimming performance is altered. Current rehabilitation technques is the use of prosthesis to regain swimming ability. In this work, analyses are focused on two dolphins with locomotive impairment; Winter (currently living in Clearwater Marine Aquarium in Florida ) and Fuji (lived in Okinawa Churaumi Aquarium in Japan ). Fuji lost about 75% of its fluke surface to necrosis (death of cells) and Winter lost its tail due to amputation. Both dolphins are aided by prosthetic tails that mimic the shape of a real dolphin tail. Using 3D surface reconstruction techniques and a high fidelity Computational Fluid Dynamics (CFD) flow solver, we were able to elucidate the kinematics and hydrodynamics and fluke deformation of these swimmers to clarify the effectiveness of prostheses in helping the dolphins regain their swimming ability. Associated with the performance, we identified distinct features in the wake structures that can explain this gap in the performance compared to a healthy dolphin.

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