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Biomimicry: The case of morphing blades

Evolution has perfected biomechanics of nature and engineering solutions can greatly benefit from it. Design can take clues from geckos climbing up vertical surfaces, a kingfisher's beak, the baobab tree, the armadillo; the spider, sunflowers, the treebot, a bird skull, etc. have been used to improve efficiency and performance of assorted designed systems. Biomimicry can also be adopted in turbomachinery, adopting fish locomotion and bird aerodynamics. Adaptive fin motion observed in cases of fish, water mammals and birds lead to the flexible blade which can greatly improve wind turbine efficiency. Whale flippers can also be adapted to improve the power output efficiency and stall characteristics of wind turbine blades. Adaptive turbine blades that vary and adjust to the airflow in order to reduce flow separation and improve power output during operating conditions can significantly impact the performance of wind turbines. Contemporary turbine blade designs are flexible in the span-wise direction to facilitate dynamic loading reduction during gusty or rapid wind changes. In this study, we present the significance of biomimicry with a wind turbine as a case study. Advances in morphing wind turbine blade and potential efficiency gains and ranges will be presented.

Biography

Asfaw Beyene received his PhD in Aeronautics and Power Engineering from Warsaw University of Technology. He joined the faculty of SDSU in 1989. His research has been concerned with energy systems: renewables, efficient power sources with emphasis on combined heat and power applications, cycle and energy analyses, mathematical modeling and simulation. He has won numerous grants from US Department of Energy, San Diego Gas and Electric, California Energy Commission, Oakridge National Lab, University City Science Center, Lockheed Martin, California Institute for Energy Efficiency and Southern California Edison Co. In his spare time, he plays soccer and skis on the famous slopes of the Sierra.

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