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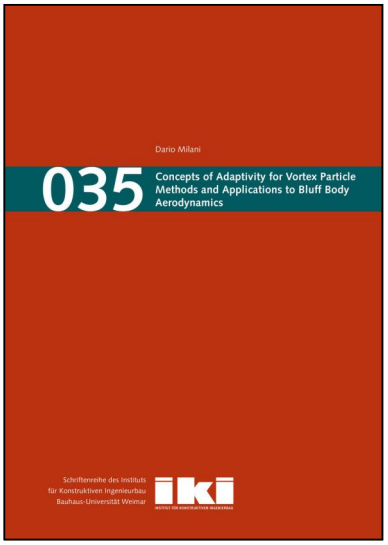
Concepts of Adaptivity for Vortex Particle Methods and Applications to Bluff Body Aerodynamics

This dissertation presents a novel adaptive solution strategy, in the framework of vortex particle methods, that allows the efficient resolution of multiple scales that are characteristic of flows around bluff bodies with small structural details. The numerical studies are further validated against Wind Tunnel tests performed by the author. Studies of accuracy and efficiency are performed by simulating the flow past the cross sections of bridges and energy harvesting devices. A substantially higher computational efficiency compared to equally accurate non-adaptive simulations is reported. Solution properties studied include the resolution of local velocity profiles and global aerodynamic coefficients. These reveal how the application of the full adaptive strategy enables for the accurate and efficient prediction of the flow features. The results indicate speed-ups of up to factor 4 to 10 when comparing the new approach to the classical Vortex Particle Method.



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