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Validity of Viscous Core Correction Models for Self-Induced Velocity Calculations

Wim Van Hoydonck, Michel van Tooren

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Viscous core correction models are used in free wake simulations to remove the infinite velocities at the vortex centreline. It will be shown that the assumption that these corrections converge to the Biot-Savart law in the far field is not correct for points near the tangent line of a vortex segment. Furthermore, the self-induced velocity of a vortex ring with a viscous core is shown to converge to the wrong value. The source of these errors in the model is identified and an improved model is presented that rectifies the errors. It results in correct values for the self-induced velocity of a viscous vortex ring and induced velocities that converge to the values predicted by the Biot-Savart law for all points in the far field.

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