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Effect of Angular Velocity on Mass Fraction Distribution for Jets Impinging on Airfoil Leading-Edge Cavity

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Abstract **-** In the present study, the effect of angular velocity on mass fraction per jet is evaluated using three dimensional numerical model. A steady state model with constant wall temperature is used to investigate the performance of seven jets impinging an airfoil leading edge cavity. The numerical simulation is conducted using ANSYS – fluent release 19.1. The study analyse the impact of jet location, jet Reynolds number and rotation number on flow behaviour and how they impact cross flow interaction. The results show that the amount of mass fraction depends mainly on channel size, jet size, jet location, rotation number and Reynolds number. The highest mass fraction is found for jets near the flow outlet while the lowest mass fraction is found from the jets in farthest distance from the outlet. Under angular velocity, that mass fraction increases with rotation number for the jet near the outlet due to centrifugal force, while decreases for the jets near the rotation axis. The rotation caused higher maximum temperature at low Reynolds number (7,500 and 10,000) while it produced lower maximum temperature at high Reynolds number (20,000 and 30,000).

Keywords**:** Jet impingements; mass fraction; leading edge cavity; rotating airfoil; effect of jet location.