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Parametric analysis of turbulent wall jet in still air over a transitional rough surface: Universal relations NOOR AFZAL, Retired — The novel scalings for streamwise variations of the flow in a turbulent wall jet over a fully smooth, transitional and fully rough surfaces have been analyzed. The universal scaling for arbitrary wall roughness is condidered in terms of the roughness friction Reynolds number (that arises from the stream wise variations of roughness in the flow direction) and roughness Reynolds number at the nozzle jet exit. The transitional rough wall jet functional forms have been proposed, whose numerical constants power law index and prefactor are estimated from best fit to the data for several variables, like, maximum wall jet velocity, boundary layer thickness at maxima of wall jet velocity, the jet half width, the friction factor and momentum integral, which are supported by the experimental data. The data shows that the two asymptotes of fully rough and fully smooth surfaces are co-linear with transitional rough surface, predicting same constants for any variable of flow for full smooth, fully rough and transitional rough surfaces. There is no universality of scalings in terms of traditional variables as different expressions are needed for each stage of the transitional roughness. The experimental data provides very good support to our universal relations.

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