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A Structural-based Interpretation of the Strouhal-Reynolds Number Relationship PEDRAM ROUSHAN, X.L. WU, University of Pittsburgh, SOFT-MATTER TEAM — We propose a new Strouhal-Reynolds number relationship for shedding of vortices from circular cylinders. This new relationship is motivated by the observations that (i) for a fixed mean velocity U, the vortex street travels at a constant velocity v_{st}=cU independent of the rod diameter D, and (ii) the spatial periodicity λ of the street is linearly proportional to D with $\lambda = \lambda_0 + \alpha$D, where c, λ_0 and α are constants. It follows that the non-dimensional frequency or the Strouhal number St(=fD/U) should scale with the Reynolds number Re as St=1/(A+B/Re), where A and B are functions of λ_0, α, and c. For the laminar wake, our result outperforms the classical relation, proposed by Lord Rayleigh, while it is comparable to other postulated relations in terms of accuracy in fitting experimental data. More significantly it describes remarkably well the two-dimensional (2D) film experiments over a broad range of Re (10<Re<3,000), where vortex shedding is unaffected by 3D instabilities encountered in all 3D measurements. We note that while the new relation converges to the classical result in the limit of a large Re, the 1/Re expansion, required for such a convergence, is not in general valid as originally proposed by Rayleigh.

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