The effect of wall shape in the friction factor of a forced flow through pipes or hoses is of interest in many applications. Several numerical and experimental studies have shown that the contribution of wall shape on the flow is not trivial even in the laminar case. The friction factor in corrugated pipes has been found to differ from the classical Moody diagram which presents the laminar friction factor as independent of wall roughness.

Available CFD computation techniques allow to predict flows in arbitrary geometry, based on these computations, the friction factor can be calculated, but this kind of procedures can become prohibitively expensive in terms of calculation time. In this talk we discuss a method for estimating the pressure losses for laminar forced flow in axially symmetric pipes with varying radius. The approach is based on an analytic expression for the friction factor, obtained after integrating the Navier-Stokes equations and an asymptotic expansion for the flow field. Examples for the validation of the method are presented.

References: