Evaluating the cylindricity of a nominally cylindrical point set

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Abstract

The minimum zone cylinder of a set of points in three dimensions is the cylindric crown defined by a pair of coaxial cylinders with minimal radial separation (width). In the context of tolerancing metrology, the set of points is nominally cylindrical, i.e., the points are known to lie in close proximity of a known reference cylinder. Using approximations which are valid only in the neighborhood of the reference cylinder, we can get a very good approximation of the minimum zone cylinder. The process provides successive approximations, and each iteration nvolves the solution of a linear programming problem in six dimensions. The error between the approximation and the optimal solution converges very rapidly (typically in three iterations in practice) down to a limit error of $\frac{4\omega_0}{R}$ (where ω_0 is the width and R is the external radius of the zone cylinder).

Keywords: metrology, minimum cylinder, zone cylinder, roundness, cylindricity