Application of Irregular Roller Burnishing in the Shaft Strengthening Process – Experimental and Numerical Study

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Abstract. In this paper, the technology of straightening of large-size dimension shafts through irregular burnishing is presented. The numerical modelling of roller burnishing has been carried out using finite element-based MSC.Marc program. The irregular burnishing is performed on the part of cylindrical surface while the opposite surface is not burnished (Fig. 1). The strengthening methodology is to introduce squeezing stresses on the dented side of a curved shaft, which cause the strengthening and the increase of fatigue durability of this area.

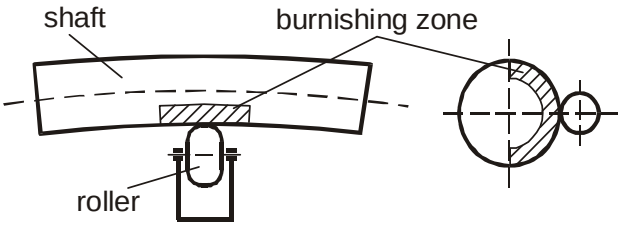

FIGURE 1. Scheme of method straightening of shafts, non–uniform burnishing

The most significant parameters in the process of strengthening of shafts are: the depth δ of the plastically deformed surface, which determines the size of introduced clenching squeezing stresses in a surface layer, the length of burnishing surface and the angle defining the width of burnishing surface. The depth δ of the plastically deformed surface is very difficult to define. It mainly depends on the force of the roller F and the radius of burnishing roller R and the yield stress R_e It can be found analytically through complicated calculations or with the time-consuming empirical method.
In order to conduct the operation of strengthening of the large-size shafts for an individual roller diameter and the corner radius, it is necessary to choose an adequate pressure force F and the burnished surface length deformation. In the process of the surface layer burnishing of a deformed shaft, a squeezing stress appears. It significantly exceeds the yield stress of shaft material. The effect on irregular roller burnishing on the depth of deformed layer has been presented and discussed.