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Conversion of Static and Dynamic Characteristic Curves of Stiffness in Series of Elastomer Couplings

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Elastomer couplings prevent fatigue and torque-peaks in drive chains. The design of couplings requires knowledge concerning the dynamic characteristic curve of stiffness. To characterize the attributes of elastomer couplings and to calculate the bearing forces the static characteristic curve of stiffness is needed. Both characteristic curves are subject to many different influences. Its identification is made mostly in component tests. A cheap and easily applicable process has been designed, that is capable to develop the characteristic curves of several sizes of one series of couplings by combining component tests and calculations.
Based on an example, including several calculations of different coupling designs, a hypothesis was constituted: The stiffness of two elastomer couplings are conform to their long scale in its third involution (scale of stiffness). Requirements are equality of design and material characteristics. The conversion of stiffness is limited to operating points of the same stress, frequency and amplitude. Characteristic curves resulting from operating points of variable initial load are converted by type wise stiffness and stress scales. The verification of this hypothesis was made in an experiment on elastomer components and couplings. Variations were made concerning type of construction, material and temperature. Series of tests made on couplings with complex behaviour of deformation also show the possibility of application of this procedure. Differences in geometrical part-dimensions cause failures in conversion. This failure scale cannot be determined by the inquest of design on its own. Differences in vulcanisation and mixture due to the size are the cause of deviations in the instance of the characteristic curves of stiffness. These influences cannot be detected a priori. The possible influence of size has to be determined in an experiment including special sizes before conversion of the characteristic curve. The conversion of stiffness with “similarity-scales” demands a complete geometrical similarity of each size. If any characteristics of the product, which are not dependent on size are to be reached, for the construction of series of couplings a similar geometrical scaling has to be chosen.