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OPTIMAL SPLINE CONNECTIONS

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In order to reduce the overall power transmitting machine dimensions the individual component strength must be increased, one possibility for this is to use optimization methods. The involved machine elements strength is typically controlled by the fatigue strength.

One of the primary machine element components used in power transmitting machines is the shaft hub connection. The torque is transferred in the connection due to contact stress. The torque can either be transferred between the two components by friction or by normal load, the latter is typically selected if demountability is important. The present paper focus is on positive connections, i.e. where there is a normal load between the shaft and hub due to a geometric locking of the two parts. The most simple form of these connections is a pin or a key joint see e.g. [1] for a standard design definition of the key and keyway. The strength of key connection is limited although design improvement by using optimization methods is possible see e.g. [2]. If one key does not have sufficient strength more keys can be added, but typically it is preferred then to use a spline. The design of splines also have a number of different standard designs.

The designs specified in standards are traditional made with straight lines and circular arches. Alternatively the involute spline can be used, for this case the cutting tool shape is made with straight lines and circular arches. The connection designs are not made with minimum stress concentrations as the main objective, easy manufacturing has the primary importance. In the present paper we show how the involute spline design can be significantly improved in relation to strength maximization by reducing the maximum stress. The maximum stress can in many cases be reduced by more than 54% relative to standard design.

REFERENCES

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