平面二次包络环面蜗杆副光弹性实验 Photoelastic Study on Planar Double Enveloping Hourglass Worm Gears

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关键词： 蜗杆 光弹性法 有限元 仿真 实验

摘 要： 通过改变固化剂的含量，配制了几种光弹性模型材料。在冻结温度下，应用YE2538型程控静态电阻应变仪测试了不同材料的弹性模量。参考钢-铜副的弹性模量比值，合理配置了蜗杆和蜗轮的光弹性模型材料。制备了钢质轴芯镶铸环氧树脂齿部的蜗杆模型，整体浇注了环氧树脂蜗轮模型。将光弹性模型副装配在减速箱中，通过扭力杆施加载荷，在烘箱内完成了应力冻结过程。应用409-Ⅰ型光弹仪观测了蜗轮模型切片等差线的分布状态。对比分析了光弹性实验结果和有限元分析结果。结果表明：同一切片上，各齿最大等差线级数的差值小，齿间载荷分配比较均匀；沿齿高方向，齿根和齿顶处的等差线级数较分度圆附近大；光弹结果与有限元计算结果的一致性较好，验证了该蜗杆副光弹性实验的可靠性。Several photoelastic materials with different ingredient proportions of firming agent were made up. Freezing elastic ratios of materials were measured by the YE2538 programmable static strain gage. According to the elastic modular ratio of the steel-copper worm gears, suitable materials for worm gears photoelastic model were selected. The worm photoelastic model was made in the way of steel mandrel surrounded with epoxy resin tooth, and the gear was made by the method of integral cast. Worm gears photoelastic model was assembled in the reduction box, and the load was applied by a torsion bar, and stress freezing was finished in the oven. Stress-difference line distribution property of sections of worm gear was observed on the photoelasticimeter 409-Ⅰ. At last, the result of photoelastic method and the result of the finite element method (FEM) were compared. The result shows that differences of the maximum fringes value among the meshing teeth are minuteness, and secondary primary stress difference at the dedendum and the addendum of the tooth is larger than that near the pitch. In conclusion, the reliability of the photoelastic experiments of the worm gears is confirmed.

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