

微热对流角速度传感器抗冲击性能分析

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摘要:

微热对流角速度传感器是一种新型的惯性传感器件, 由于采用流体代替传统的固体质量块作为敏感载体, 因而具有极其独特的性能, 特别是高抗冲击性。采用ANSYS有限元分析软件, 对微热对流角速度传感器的加热丝支撑层和检测丝支撑层进行动静态变形和应力计算, 得出应力最大点, 微加热丝支撑层的应力最大点在固支位置附近, 检测丝支撑层的应力最大点在固支位置附近和内拐角处。在z方向有一定加速度载荷作用下, 加热丝支撑层的最大应力比检测丝支撑层的最大应力大, 更容易破坏。理论计算得到微热对流角速度传感器样品可抗冲击200000g, 经过抗冲击实验验证, 微热对流角速度传感器样品在21200g的冲击下仍完好无损, 有极好的抗冲击性能。

关键词: 微热对流, 角速度传感器, 抗冲击性, ANSYS

Angular Rate Sensor based on Convection Heat Transfer

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Abstract:

Micromachined thermal gas angular rate sensor is kind of novel inertial device, which takes an advantage of high shock resistance due to use gas instead of conventionally used proof-mass as the key sensing element. The calculation of the static and transient strain and stress in supporting layer of heating wire and detection wires is performed, and the position with the largest stress is figured out by means of finite element software ANSYS. The results show that the largest stress point of support layer of heating wire is close to the clamped edges. The largest stress point of support layer of detection wire is close to the clamped edges and corners. When an acceleration loading is applied along z direction, the largest stress of support layer of heating wire is larger than that of support layer of detection wire. Experimental results show that our device can withstand the shock of 21200g, and the theoretic prediction of the shock resistance of the device can reach 200000g, all of which indicates the sensor has a good shock resistance.

Keywords: micro-thermal convection; angular rate sensor; shock resistance; ANSYS

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