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高速小展弦比机翼颤振的微分求积法分析

Flutter analysis of low-aspect-ratio wing by differential quadrature method

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中文摘要：

　　引入微分求积法,分析高速小展弦比机翼的气动弹性问题。将小展弦比机翼等效为悬臂板,基于一阶活塞气动力理论建立机翼颤振偏微分方程,采用微分求积法将偏微分方程转化为常微分方程,根据频率重合理论对颤振问题进行求解。分析了机翼的固有频率及颤振速度,并与有限元软件计算结果进行比较,误差在2%以内,很好的验证了微分求积法求解小展弦比机翼颤振问题的有效性。分析了机翼面积、展弦比及厚度对颤振速度的影响,结果表明,小展弦比机翼的颤振速度受结构尺寸的影响较大,颤振速度随面积和展弦比的增大而减小,随机翼厚度的增大而增大。

英文摘要：

　　This paper introduces the differential quadrature method to solve the aeroelastic problem of low-aspect-ratio wing.Low aspect ratio wing flutter partial differential equations are established based on the first order piston theory,and solved based on the frequency coincidence theory. The natural frequency and flutter velocity are analyzed by DQM and FEM, the result shows that the relative errors between DQM and FEM are within 2%. So the differential quadrature method is very effective to the solve flutter problems of low aspect ratio wings.Analysis of the effects of wing area,aspect ratio and thickness on flutter speed,the results showed that: flutter speed of the low-aspect-ratio wing greatly influenced by the structure size,with the wing flutter speed area,the aspect ratio of the decreases,with the wing thickness increases.

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