

基于计算机视觉与敲击振动融合技术检测鸭蛋壳强度Duck Egg's Shell Intensity Model Based on Fusion of Computer Vision and Impact Excitation

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关键词: 鸭蛋 蛋壳强度 多传感器融合 数据关联 多元线性回归 模型

摘要: 通过对敲击振动特征频率矩阵变异系数和测定有裂纹蛋壳强度的探索性分析, 获得鸭蛋壳强度特征频率的分离阈值 $\lambda=0.02$ 。通过传感器数据关联, 确定了进入模型的特征变量。采用后向消去法进行多元线性回归建立了无裂纹鸭蛋壳强度预测模型, 结合蛋壳强度分离阈值得出基于特征层多传感器融合鸭蛋壳强度的系统模型。验证性试验表明该模型有较好适应性, 对于各种颜色、形态鸭蛋的蛋壳强度都有较好的预测效果, 误差均值小于3.1%, 误差标准差为0.003。Computer vision analysis and impact excitation frequency analysis were used to construct the duck egg's intensity model. By the analysis in the CV (coefficient of variation) of the duck egg's impact excitation frequency and the analysis of the crack egg's intensity, the threshold value ($\lambda=0.02$) which can be applied to distinguish the duck egg intensity at the level of 1MPa (confidence at the level of 95%) was obtained. Then the characteristic variables were entered into the model. The backward elimination procedure was used to perform multi-dimensional linear regression in order to establish the forecast model of the non-crack duck eggs' shell intensity. Combined with the threshold value which had been obtained, the system model of duck egg's shell intensity based on the multi-sensor fusion can be obtained. The confirmation experiment indicates that the model had good adaptability on duck eggs with different color and mass, the model shows high accuracy (the mean of forecast error is 3.1%) as well as good stability (the standard deviation of forecast error is 0.003).

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