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Response surface methodology approach to evaluate the effects of process parameters of bamboo sliver cutting operation energized by human powered flywheel motor

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As energy usage across the world continues to rise, there is a strong need to develop new methods for energy conservation and power generation, particularly approaches that have less environmental impacts. It is present need to find out an alternative to the renewable energy sources which will be suitable to use at any time and at any place which is reachable to general user. Human power is one such form of renewable energy that has been used historically to varying degrees. In this context, this work comprises of design and fabrication of pedal powered bamboo slivering machine which is energized by human powered flywheel motor (HPFM). A human being can pedal a bicycle at 75 W power input rate conveniently. A bicycle mechanism is pedalled to store kinetic energy in a flywheel and then spinning flywheel is clutched to process unit to transfer the motion to the slivering unit. This paper presents the development of the experimental based mathematical models for cutting the slivers from bamboo by means of human powered flywheel motor (HPFM) and the evaluation of the effects of various process parameters on the responses like processing time, number of slivers and resistive torque of bamboo slivering operation. There are various parameters viz. dependent and independent variables involved in the process of cutting the bamboo sliver by HPFM. Therefore, apart from formulation and development of the model on the basis of experimentation theory suggested by Hilbert Schenck Jr., the optimization is done to find the best sets of the independent variable to achieve the responses as an output. In this work, the responses of three response variables such as number of slivers, processing time and resistive torque are experimentally studied by carrying out total 108 sets of experiments. The experimental models for these three response variables are optimized to get the best set of independent variables involved in the bamboo sliver cutting process and by response surface methodology approach, the effects of various independent parameters in bamboo sliver cutting operation were studied.

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