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[F] PhD Extended Abstract Form *(Please select the Calibri 10 typeface)*

DESIGN AND DEVELOPMENT OF VIBRATORY TILLAGE CULTIVATOR...

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Extended Abstract

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Agriculture plays a vital role in India and tillage system design is one of the important area of interest for farming community. Cultivator is a kind of soil engaging tool that is extensively used by farmers makes us to think and work on application of vibration to the cultivator tillage system due to the advantages of vibratory tillage systems such as reduced draft and power requirements. In this thesis a vibratory tillage cultivator is designed and developed with improved agricultural parameters. In this study a mechanism is designed and developed through the principles of mechanism synthesis such as graphical, analytical, and optimal methods. An experimental tillage tool trajectory is selected from the literature, and a four-bar mechanism is designed. This whole process is carried out to identify the mechanism dimensions of the four-bar mechanism which will provide vibratory motion to the tillage tool. Optimal methods are also explored in this work and applied for the specific vibratory tillage operation through selected objective function. Different algorithms are used as a solver such as Hybrid teaching-learning particle swarm optimization (HTLPSO), Particle swarm optimization (PSO), and Teaching learning-based algorithm (TLBO) to yield the solution that is four-bar mechanism dimensions. The synthesized mechanism is simulated in MATLAB to observe the mechanism tracing of the experimental trajectory. It is established that the four-bar mechanism traces the path or trajectory precisely with minimum error. Thus for the vibratory tillage operation the mechanism is proposed. The study in the thesis also includes the design and development of the vibratory tillage cultivator. The final dimensions of the machine are calculated through agricultural principles. Four bar mechanism designed through the synthesis procedure is mounted on the cultivator frame to make the device active. A power transmission system arrangement is made for the designed vibratory tillage cultivator. Finally, through the preliminary performance evaluation, it is observed that the developed vibratory tillage cultivator consumes 23 percent less draft as compared to passive rigid cultivator. The power also reduced significantly by 18 percent as compared to the passive rigid cultivator with improved soil parameters. Fuel consumption is noted to be 2-3 litre/hr and depth as 15-25 cm for the developed vibratory tillage cultivator which also improved significantly. Static force analysis also concluded that the designed vibratory tillage cultivator is within the safe limits when different loads are applied. Thus the farmers can use this implement with improved agricultural parameters.

Keywords: Soil, vibratory tillage, four bar mechanism, optimization algorithms