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LASER BRIGHTNESS AND FOCAL LENGTH VARIATIONS AS KEY PARAMETERS IN ACHIEVING HIGH OPERATION EFFICIENCY AND DESIGN EFFECTIVENESS FOR ENERGY TRANSMISSION OVER INCREASING EMITTER-TRANSDUCER DISTANCES

Abstract

The need to realize more effective laser systems and exploit their full potential in aerospace applications has led to significant developments of lasers, optical systems, and laser-powered systems. This research aims at investigating and understanding the influence of laser parameters variation and the outcome in terms of received and converted energy. To achieve optimal conditions and effective operations at a very low cost, transducers have been used in order to investigate the relationship between laser parameters variation and the exploitability of such a system design. To support our results and conclusions, achieving different outcomes by converting the received energy through the transducer with a very low input power over an increasing distance separating the laser source from the transducer itself is deemed as evidence of this design effectiveness. When compared with other studies, the efficiency usually decreases proportionally with the input power and emission time, similar results are expected if the distance separating the source and the target increases. In this study, these phenomena can be reversed in a way that the output power and delivered energy would not change, or even kept at very low values, while the laser source-transducer distance is increased. This can be achieved by manipulating and controlling parameters that are of a paramount importance, such as, but not limited to, laser brightness and beam diameter variation, focal length displacement over the laser emitting source-transducer distance, as well as the nature of the targeted medium. The most noticeable fact is that optimal results can be easily achieved if these parameters are controlled simultaneously.