Optimisation of Sheet Metal Cutting with a High Power, Variable Mode Fibre Laser

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General-purpose laser cutting systems, such as those used in a job shop, must be able to cope with an array of material types and thicknesses. The optimal laser beam parameters for a given sheet metal type and thickness will be distinct in terms of beam shape, focal spot size, beam quality and divergence. For example, when cutting thin stainless steel, a small focal spot diameter is required with low beam divergence whilst for cutting thick mild steel a larger focal spot is needed with higher divergence. The choice of fixed laser beam parameters and beam delivery optics are therefore a compromise to achieve acceptable quality and speed performance across the whole sheet metal range. One option is to use a cutting head with a zoom collimator, which allows the focal spot size to be varied, however the process head becomes bulky and expensive and does not change the spatial intensity profile, only the beam diameter. Another option is to use a laser which can vary the output beam parameters, including the intensity profile, so that a closer match to the optimal cutting regime can be achieved. In this paper the cutting performance of a high power variable mode fiber laser will be discussed, comparing results optimised for given metal types and thickness to standard cutting results using the same output power but with fixed beam parameters. Factors such as maximum cutting speed, process bandwidth and cut-edge quality will be considered.