LASER BENDING OF MILD STEEL BY APPLYING ELECTROMAGNETIC FORCE AND WATER JET COOLING

A THESIS
SUBMITTED TO

MAHARAJA RANJIT SINGH
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IN FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

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IN
Mechanical Engineering

By
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CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis, entitled "**Laser Bending of Mild Steel by applying Electromagnetic Force and Water Jet Cooling**" in fulfilment of the requirements of the award of the degree of Doctor of Philosophy in Faculty of Mechanical Engineering and submitted in Maharaja Ranjit Singh Punjab Technical University, Bathinda is an authentic record of my own work carried out during a period from February 2021 to March 2024 under the supervision of Prof. (Dr.) Balwinder Singh Sidhu and Dr. Ravi Kant.

The matter embodied in this thesis has not been submitted by me for the award of any other degree of this or any other University/Institute.

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Yadwinder Pal Sharma

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LIST OF ABBREVIATIONS

BM	Buckling Mechanism
CMM	Coordinate Measuring Machine
CNC	Computer Numerical Control
EMLF	Electromagnetic Force Assisted Laser Bending
FEM	Finite Element Method
HAZ	Heat Affected Zone
IR	InfraRed DAQ Data Acquisition
SEM	Scanning Electron Microscopy
TGM	Temperature Gradient Mechanism
UM	Upsetting Mechanism
UTM	Universal Testing Machine
UTS	Ultimate Tensile Strength

LIST OF SYMBOLS

η	Absorption Coefficient of Worksheet Surface
D	Laser Beam Diameter
ρ	Density of Worksheet Material
ε	Worksheet Surface Emissivity
h	Convective Heat Transfer Coefficient
k	Thermal Conductivity
N	Number of Passes/Scans
P	Laser Power
R	Laser Beam Radius
T	Sheet Thickness
Tavg.	Average of the Maximum Temperature
Te	Environmental Temperature
Ts	Temperature at Worksheet Surface
V	Laser Scanning Speed
w	Width of the Worksheet
λ	Wavelength of Fiber Laser Beam