

Highlights:

- An original accurate material removal model has been established by considering the Dynamic floating of honing tool system with four unconstrained degrees of movement freedom.
- Minimum energy principle was incorporated into the effect of free-floating movement to achieve the most stable state of honing head by overcoming the static and independent analysis by existing research literature.
- Function F objective from material removal matrixes of all oilstones was applied to dynamically identify the oilstones' material removal processes.
- The single stage honing experiment was conducted to validate the authenticity and credibility of the newly proposed analytical model in terms of the effects of bore diameter enlarging and inner wall profile error reflection.