

活塞表面仿生非光滑微坑贮油润滑机理的任意拉格朗日-欧拉法有限元模拟

杨洪秀<sup>1</sup>,左文杰<sup>2</sup>,李亦文<sup>2</sup>,任露泉<sup>1</sup>

1.吉林大学 地面机械仿生技术教育部重点实验室, 长春 130022; 2.吉林大学 机械科学与工程学院, 长春 130022

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摘要

针对活塞表面仿生非光滑微坑贮油润滑问题, 采用ALE(Arbitrary Lagrange-Euler)有限元法建立了追踪润滑油晃动的数学模型。利用非线性有限元求解器LS-DYNA仿真了润滑油晃动的自由液面形状与压力云图, 直观地显示了非光滑微坑中润滑油晃动的整个动态过程。对半球形、圆锥形与楔形非光滑贮油微坑的润滑能力进行了对比数值模拟。结果表明, 楔形微坑的润滑效果最好, 与实验结果吻合。

关键词 [工程仿生学](#) [仿生非光滑](#) [活塞润滑](#) [任意的拉格朗日-欧拉法有限元法](#)

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## ALE finite element simulation of oil storage lubrication mechanism on bionic nonsmooth micro-pits in piston surface

Yang Hong-xiu<sup>1</sup>, Zuo Wen-jie<sup>2</sup>, Li Yi-wen<sup>2</sup>, Ren Lu-quan<sup>1</sup>

1.Key Laboratory for Terrain Machine Bionics of Engineering, Ministry of Education, Jilin University, Changchun 130022, China; 2.College of Mechanical Science and Engineering, Jilin University, Changchun 130022, China

**Abstract** An arbitrary Lagrange Euler(ALE) finite element method was introduced to build a mathematical model to trace the sloshing of the lubricating oil in the micro pits on the piston surface to help understanding the oil storage mechanism of the bionic nonsmooth surface. The free surface profile and the pressure cloud diagram of the lubricating oil sloshing were simulated by the nonlinear finite element solver LS-DYNA, demonstrating intuitively the whole dynamic process of the lubricating oil sloshing in the nonsmooth micro pit. The lubricating capability of the hemisphere, taper, and cuniform oil storage micro pits were simulated comparatively and the result showed that the lubricating capability of the cuniform micro pit is the best, being in agreement with the experiment.

**Key words** [engineering bionics](#) [bionic nonsmooth](#); [piston lubrication](#); [arbitrary Lagrange Euler\(ALE\) finite element method](#)

DOI:

通讯作者 左文杰 [zuowj2008@qq.com](mailto:zuowj2008@qq.com)

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