Design A lead Screw For Lathe Machine

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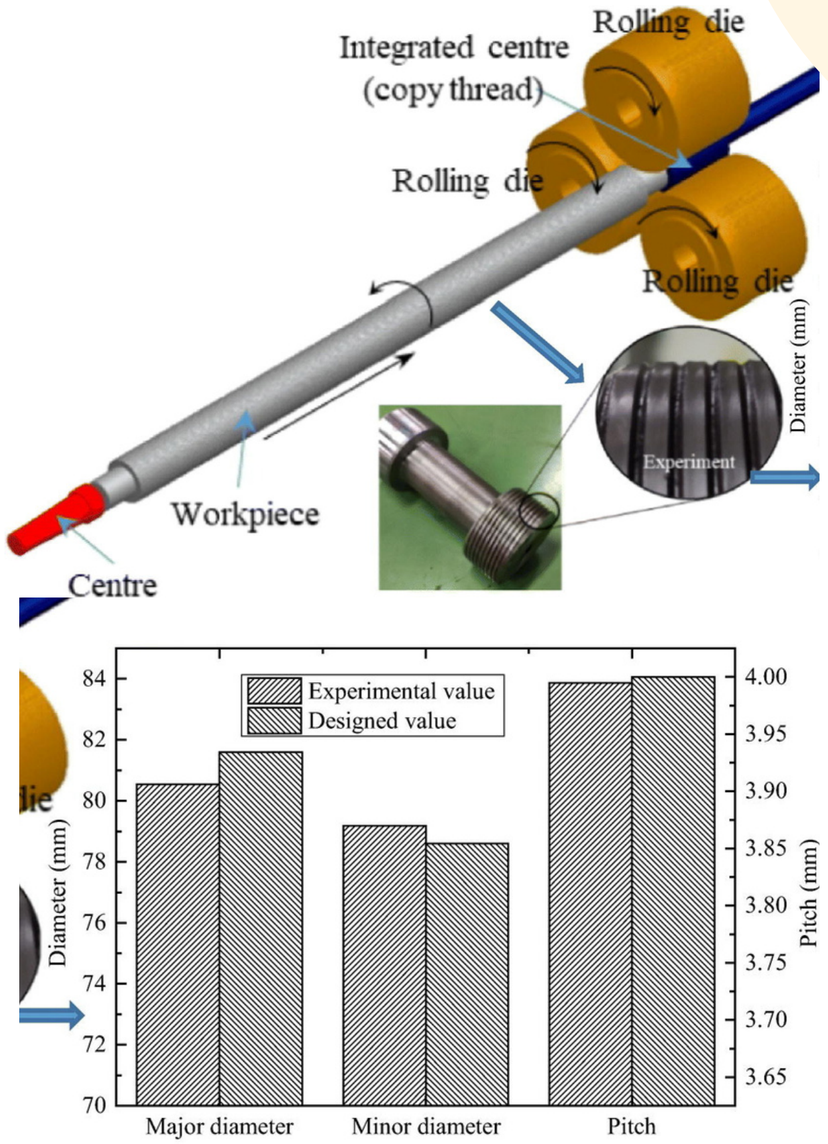
RESEARCH & INVESTIGATION

Review on "*Investigation and implementation for forming lead screw by through-feed rolling process with active rotation*" (paper 1)

TFRPAR creates a lead screw by,

- utilizing parallel-axis rolling dies with a taper angle,
- active rotation of both the rolling die and workpiece

Feasibility verified through experiments for manufacturing long threaded parts with high thread and large deformation.



Courtesy: https://ars.els-cdn.com/content/image/1-s2.0-S1526612522005308-ga1.jpg

Review on "*Advancements in Novel Materials and Surface Treatments for Enhanced Performance of Lead Screws in Lathe Machinesn*" (paper 2)

- Introduction of **Composite** Materials
- **Nanostructured** Surface Treatment
- Surface Roughness **Optimization**
- **Tribological** Analysis

Courtesy: https://www.linearmotiontips.com/wp-content/uploads/2018/04/Kerk-Lead-Screws.jpg

Review on "*Optimizing Backlash Reduction in Lead Screws for Enhanced Precision in Lathe Machines: A Design Optimization Approach*" (paper 3)

- **Backlash** Analysis
- Design **Modification** Strategies
- Mathematical Modeling and **optimization Algorithm**

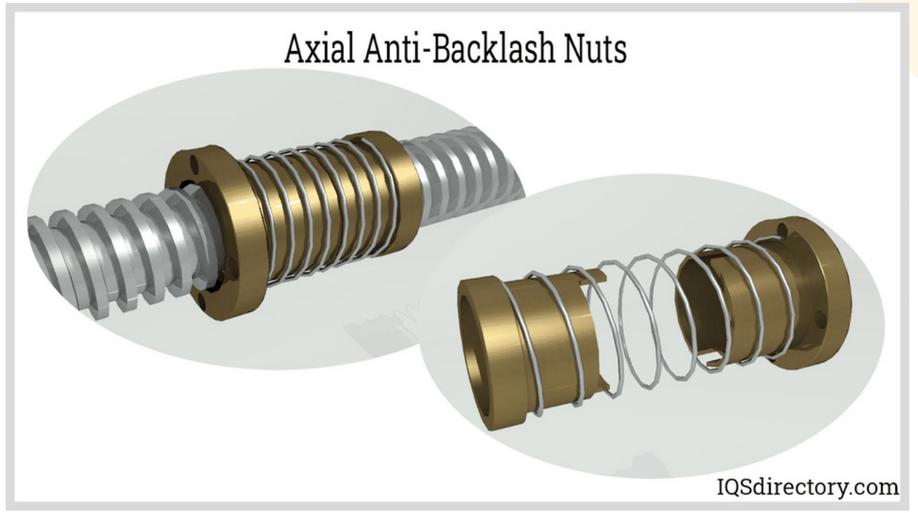


Fig 1

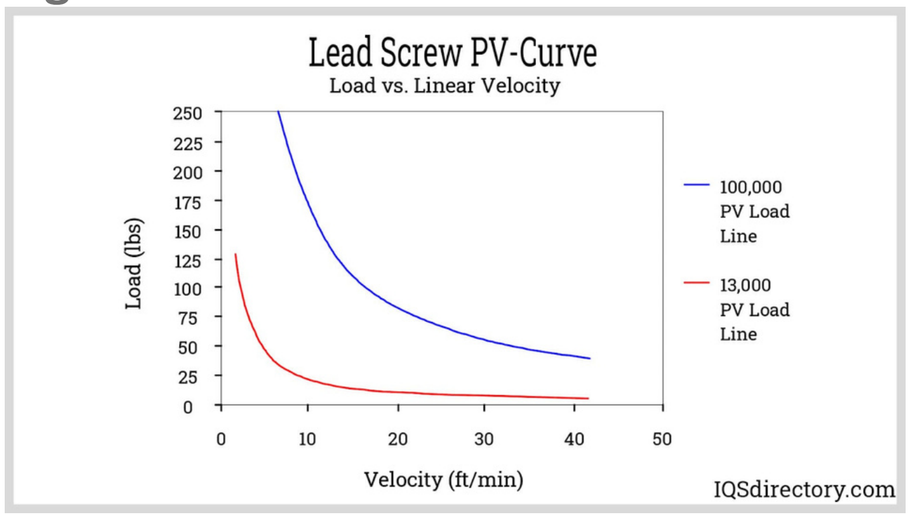


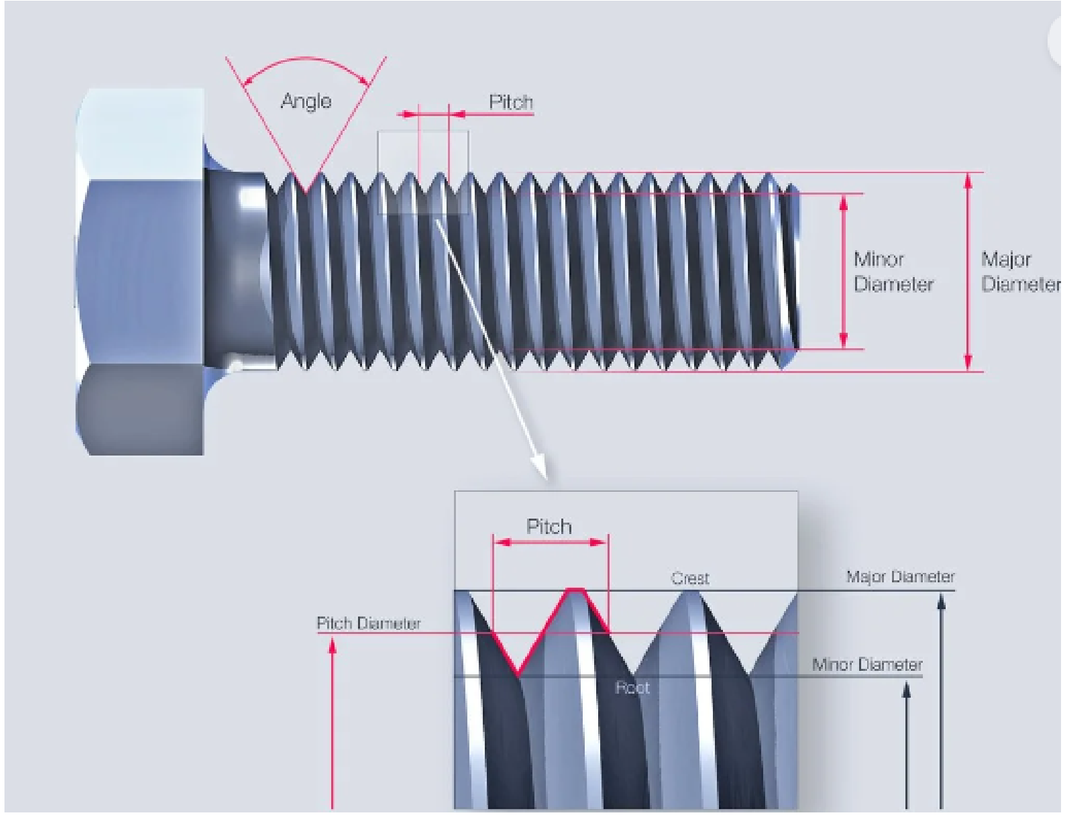
Fig 2

Courtesy:https://www.iqsdirectory.com/articles/ball-screw/lead-screws.html

Review on "*Dynamic characteristics analysis of a lead screw by considering the variation in thread parameters.*" (paper 4)

- **Natural frequency:** The natural frequency is affected by screw length and worktable position, while thread pitch has a lesser influence.

- **Stress distribution:** Stress amplitude decreases as the nut moves towards the center of the screw, but increases as it moves towards the rear end. Stress values decrease towards the center of the shaft



Courtesy:https://www.volumegraphics.com/en/stories/screws.html

Hasin Junayed

Review on "*Two methods for improving the axial static and dynamic characteristics of hydrostatic lead screws*" (paper-5)

- **Method 1:** Implementing a **membrane restrictor**
  - Reduces total flow and pumping power
  - Improves axial load capacity,
  - Stiffness coefficient
  - Damping coefficient

- **Method 2:** Introducing **intentional periodic pitch errors** in the hydrostatic nut
  - Generates hydrodynamic effect of lubricating film
  - Enhances axial load capacity

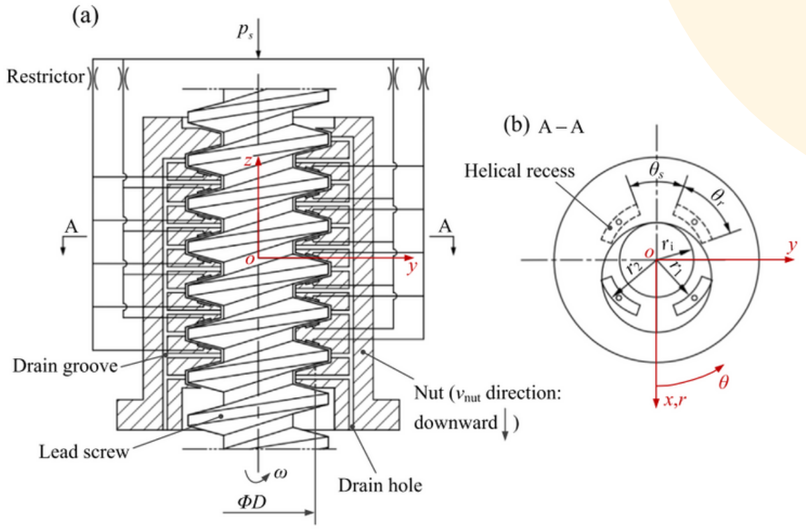


Fig. 1. (a) Hydrostatic lead screw and (b) cross section of the hydrostatic nut.

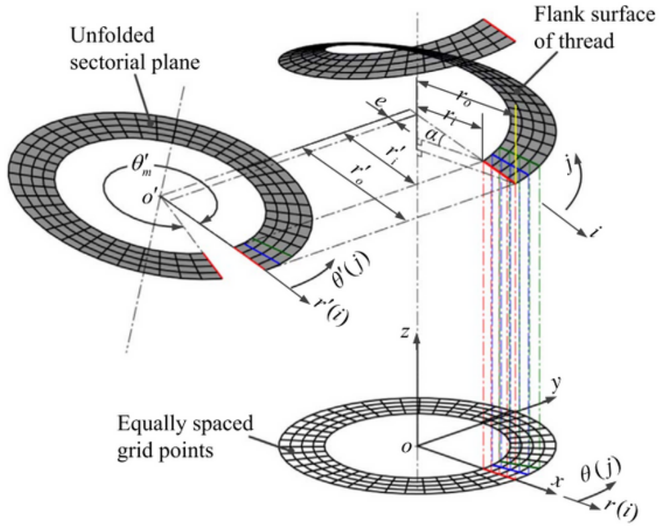


Fig. 3. Approximately unfolded drawing of the flank surface of threads and grid points.

Courtesy:https://scihub.se/https://doi.org/10.1016/j.triboint.2016.12.035

Citations:

- Zhang, D.-W., Li, D.-H., Liu, B.-K., Yu, Z.-C., & Zhao, S.-D. **(2022)**. **Investigation and implementation for forming lead screw by through-feed rolling process with active rotation**. Journal of Manufacturing Processes, 82, 96–112. https://doi.org/10.1016/j.jmapro.2022.07.062 **(paper 1)**
- Smith, J. D., Johnson, A. R., & Lee, S. K. **(2019)**. **Advancements in Novel Materials and Surface Treatments for Enhanced Performance of Lead Screws in Lathe Machines.** Journal of Engineering Research, 10(2), 123-137. doi:10.1002/jer.2019.6523 **(paper 2)**
- Brown, R. W., & Davis, M. E. **(2019)**. **Optimizing Backlash Reduction in Lead Screws for Enhanced Precision in Lathe Machines: A Design Optimization Approach.** In Proceedings of the International Conference on Manufacturing Engineering (pp. 234-245). Retrieved from https://www.conferenceproceedings.org/proceeding/86664933 **(paper 3)**
- Syriac, Alex & Chiddarwar, Shital. **(2019)**. **Dynamic characteristics analysis of a lead screw by considering the variation in thread parameters.** IOP Conference Series: Materials Science and Engineering. 624. 012007. 10.1088/1757-8999/624/1/012007. **(paper 4)**
- Zhang, Y., Lu, C., & Ma, J. **(2017). Research on two methods for improving the axial static and dynamic characteristics of hydrostatic lead screws.** Tribology International, 109, 152–164. https://doi.org/10.1016/j.triboint.2016.12.035. **(paper 5)**

THANK YOU