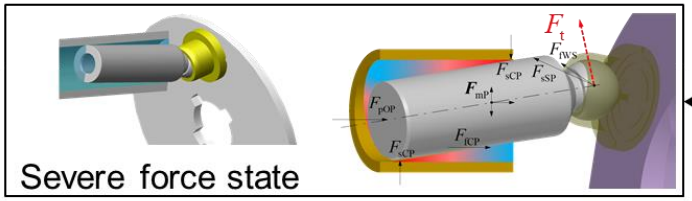
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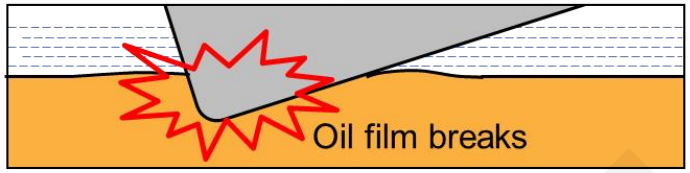
Wear map-based wear prediction method for the piston–cylinder interface in axial piston machines

Fei LYU, Xudong SHEN, Felix SCHLEGEL, Xiaolong ZHANG, Liangyu SONG, Junhui ZHANG, Katharina SCHMITZ, Bing XU

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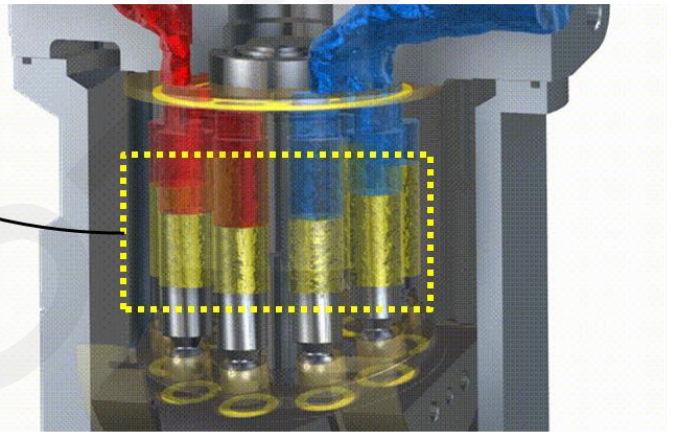
Background & Motivation







Piston/cylinder interface (PCI)



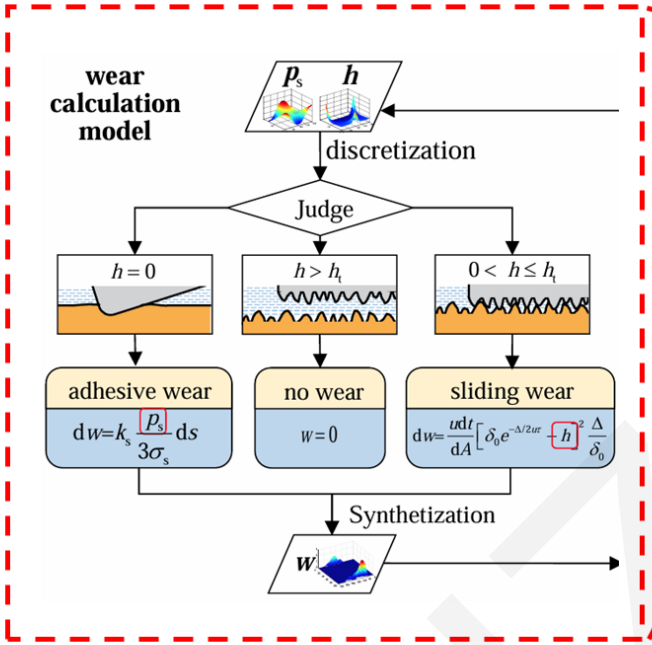
Aixal piston machine（APM）

Efficiency decrease
Fluid contamination
Abrupt failure of the system
…

Research objective: Predicting the wear process to enhance the performance and reliability

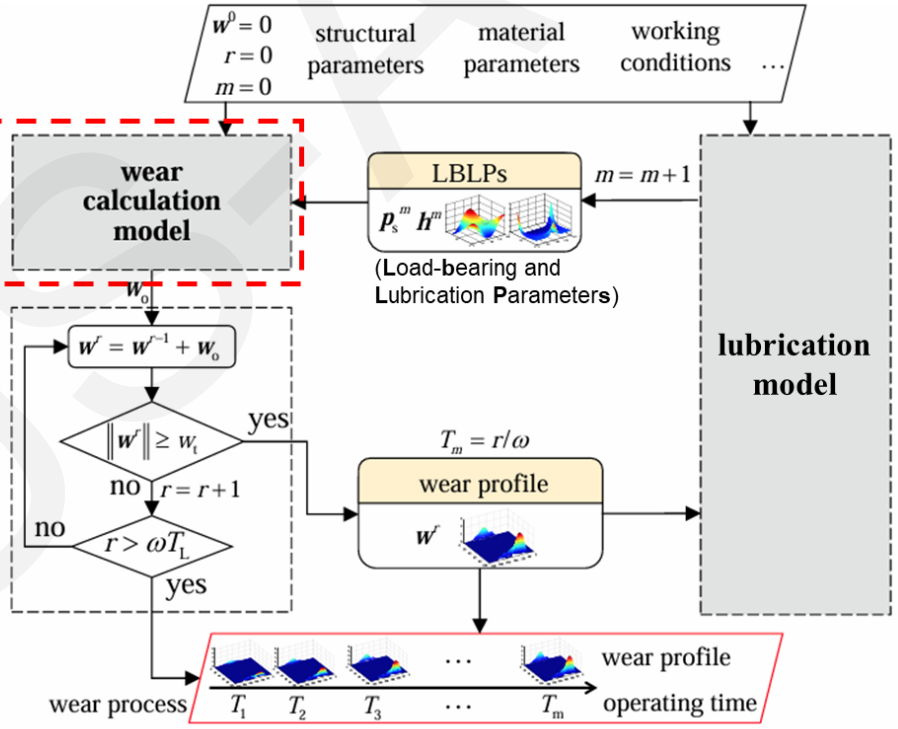
Background & Motivation

Existing wear prediction models





Hard switch method is too idealistic in both wear judgment and calculation



Lyu, et al. Wear, 2020

Challenges: Obtaining accurate lubrication regimes and using the appropriate wear mechanisms

Method

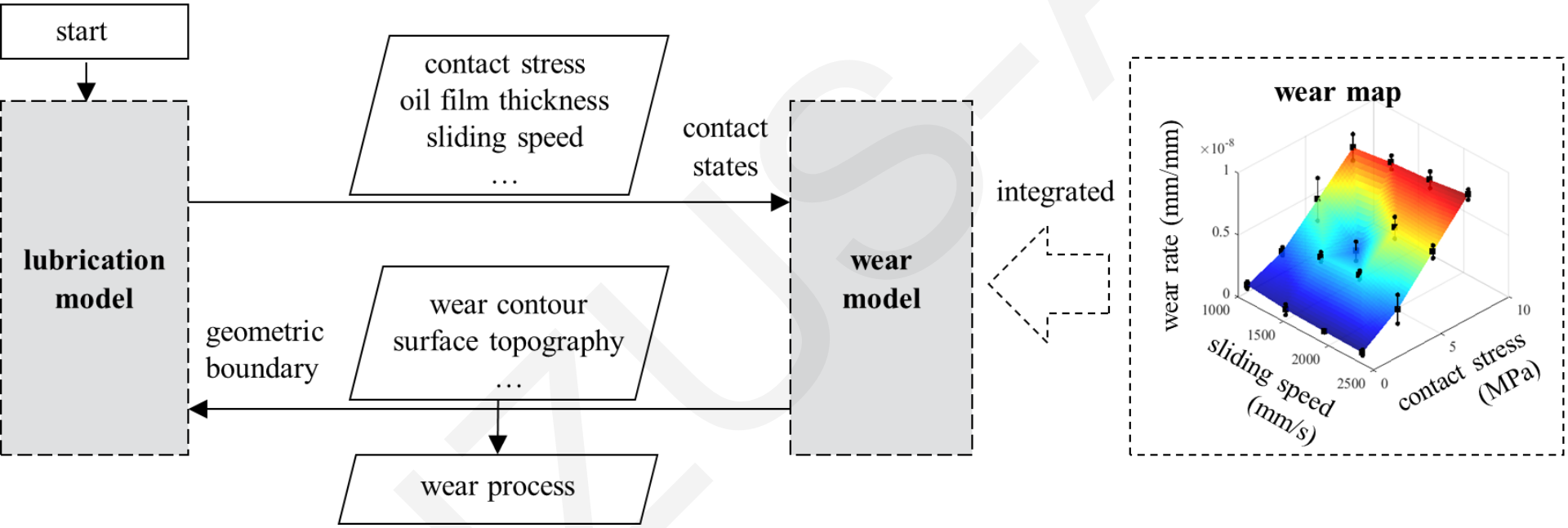


Fig. 2 Brief flowchart of the PCI wear prediction method

Experiments

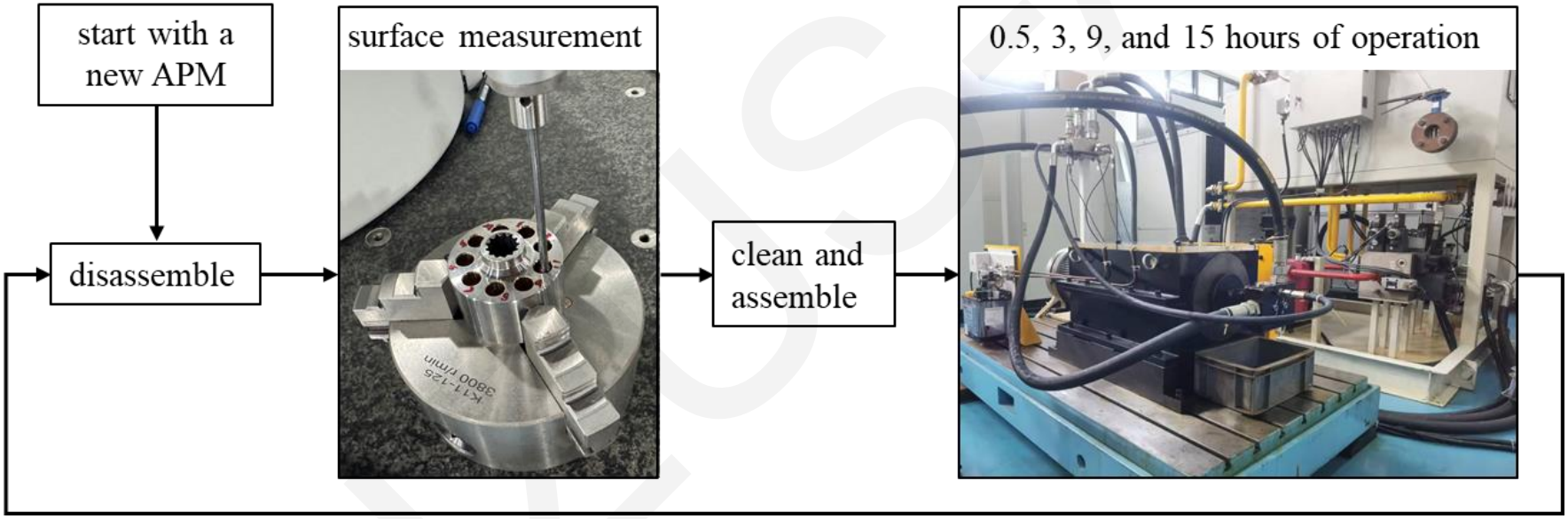


Fig. 10 Process of the APM wear test

Results

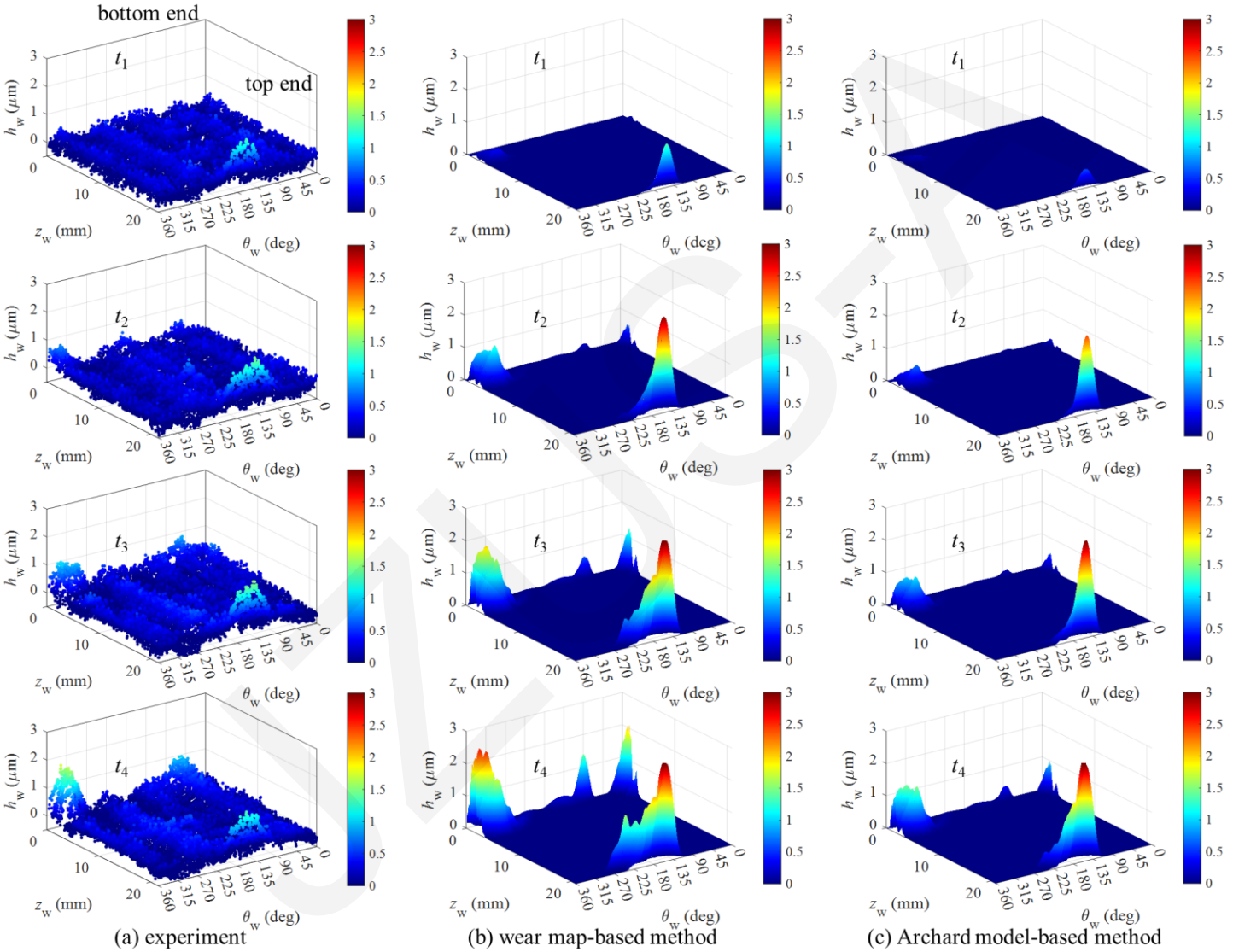


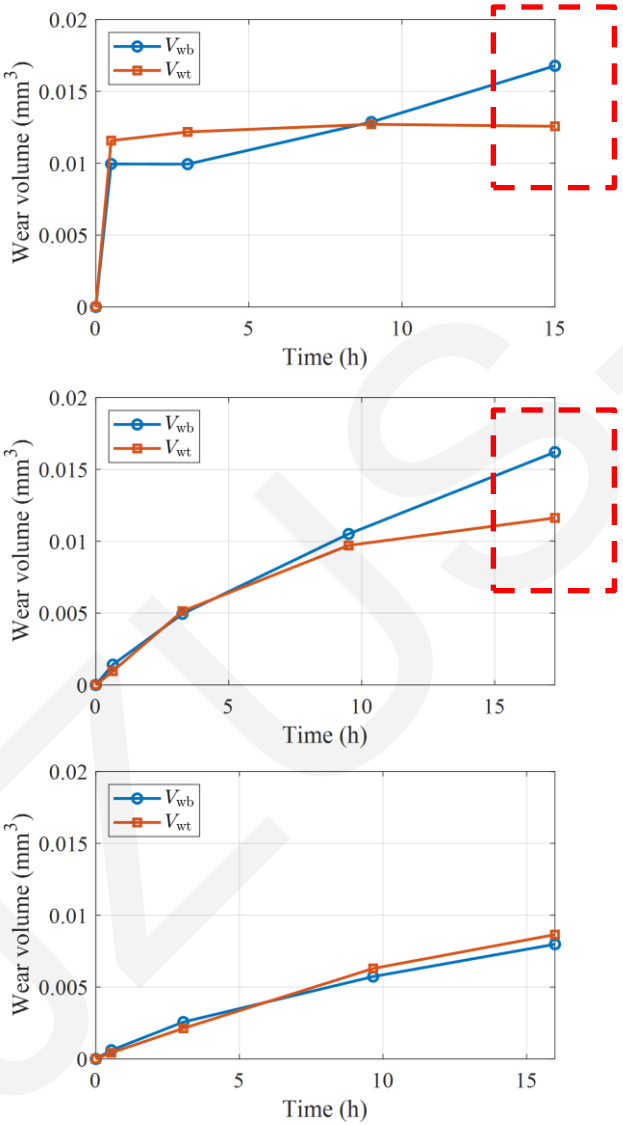
Fig. 11 Evolution of the PCI wear contour predicted by different approaches: (a) experimental method; (b) wear map-based method; (c) Archard model-based method

Results

(a) experiment

(b) wear map-based method

(c) Archard model-based method



The wear map-based method captured this redistribution more consistently

Fig. 12 Quantitative evolution of the wear volumes at top end and bottom end: (a) experimental method; (b) wear map-based method; (c) Archard model-based method

Conclusions

- The wear map-based method has the capability to predict the wear behavior at the PCI with multiple coexisting contact states. Targeted engineering implications can be drawn.
- Candidate material pairing and surface condition for the PCI in APMs can be screened by initial disk-on-disk tribometer tests combined with wear prediction, without the immediate need for APM prototyping.
- For existing APMs, a more targeted and physics-consistent wear prediction can be provided to support predictive maintenance.