

Effects of index angle on flow ripple of a tandem axial piston pump

Bing Xu, Shao-gan Ye, Jun-hui Zhang

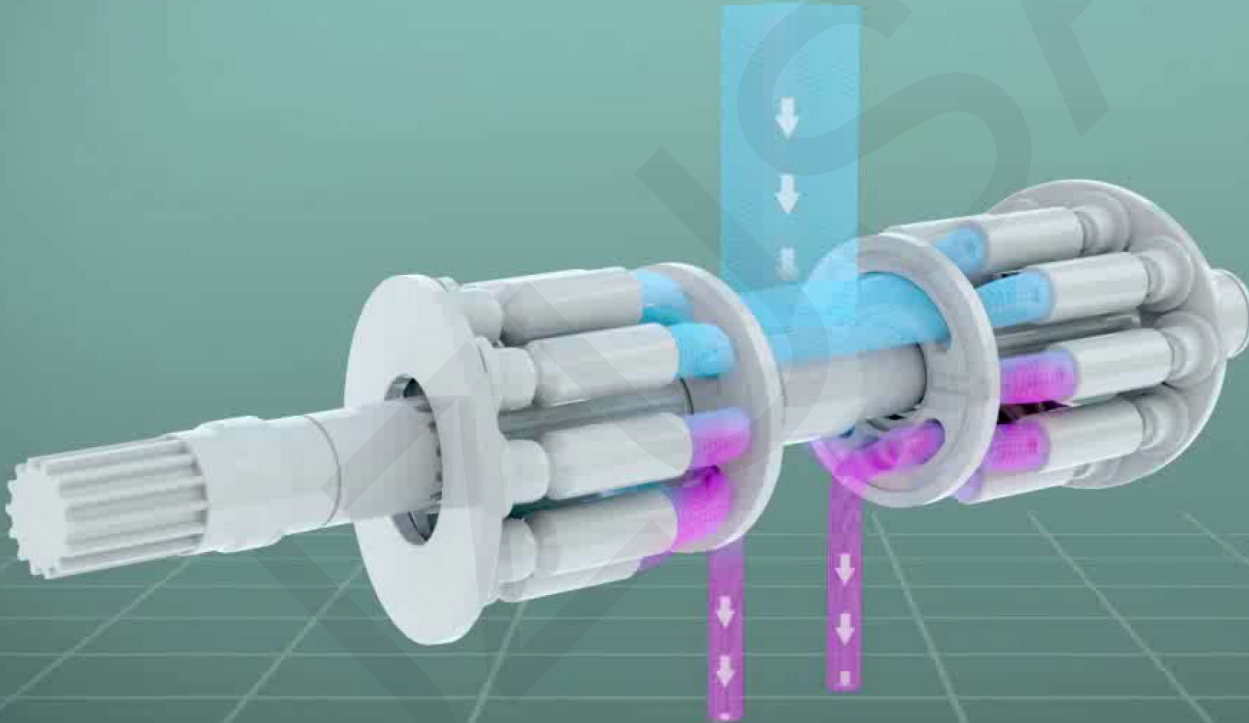
bxu@zju.edu.cn, ye.shaogan@163.com, benzjh@gmail.com

State Key laboratory of Fluid Power Transmission and Control, Hangzhou, China

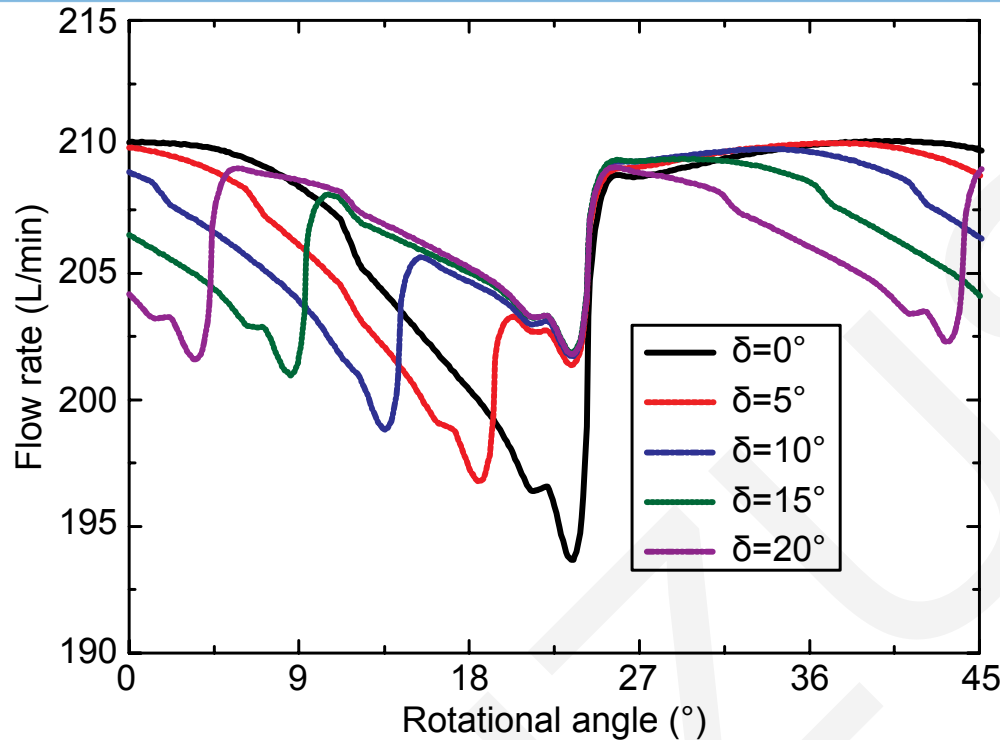
Key words: Axial piston pump, Flow ripple, Index angle, Sensitivity analysis

Cite this as: Bing XU, Shao-gan YE, Jun-hui ZHANG, 2015. Effects of index angle on flow ripple of a tandem axial piston pump. *Journal of Zhejiang University Science A (Applied Physics & Engineering)*, 16(5): 404-417. [doi:10.1631/jzus.A1400309]

Description



Best index angle

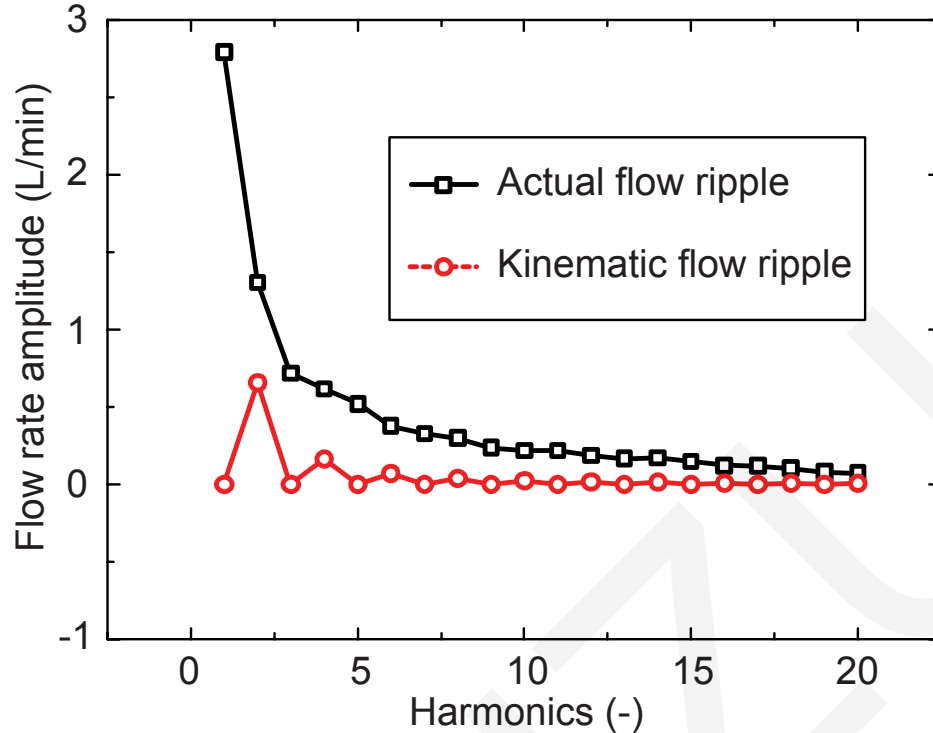


Variations in flow ripple

- Time domain;
- One period;
- Amplitude.

- The best index-angle is determined;
- Flow ripple decreases as the index angle increases.

The reasons

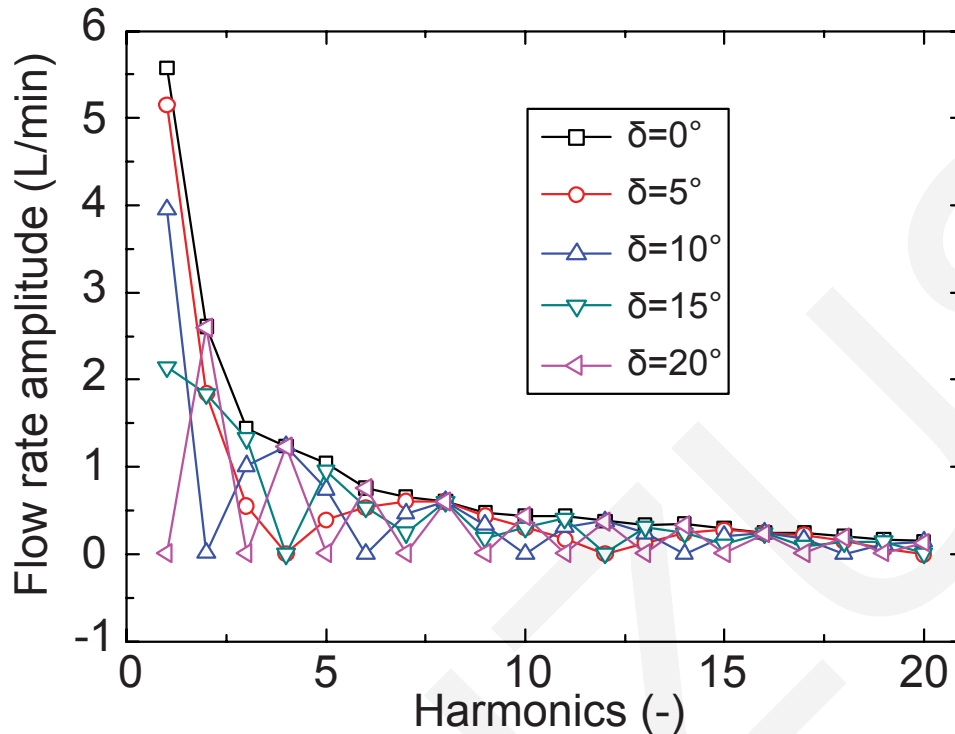


Flow ripple comparisons

- Kinematic component;
- Dynamic component;
- Actual component.

- Dynamic component is larger than kinematic one;
- Actual component is rich in harmonics.

The reasons

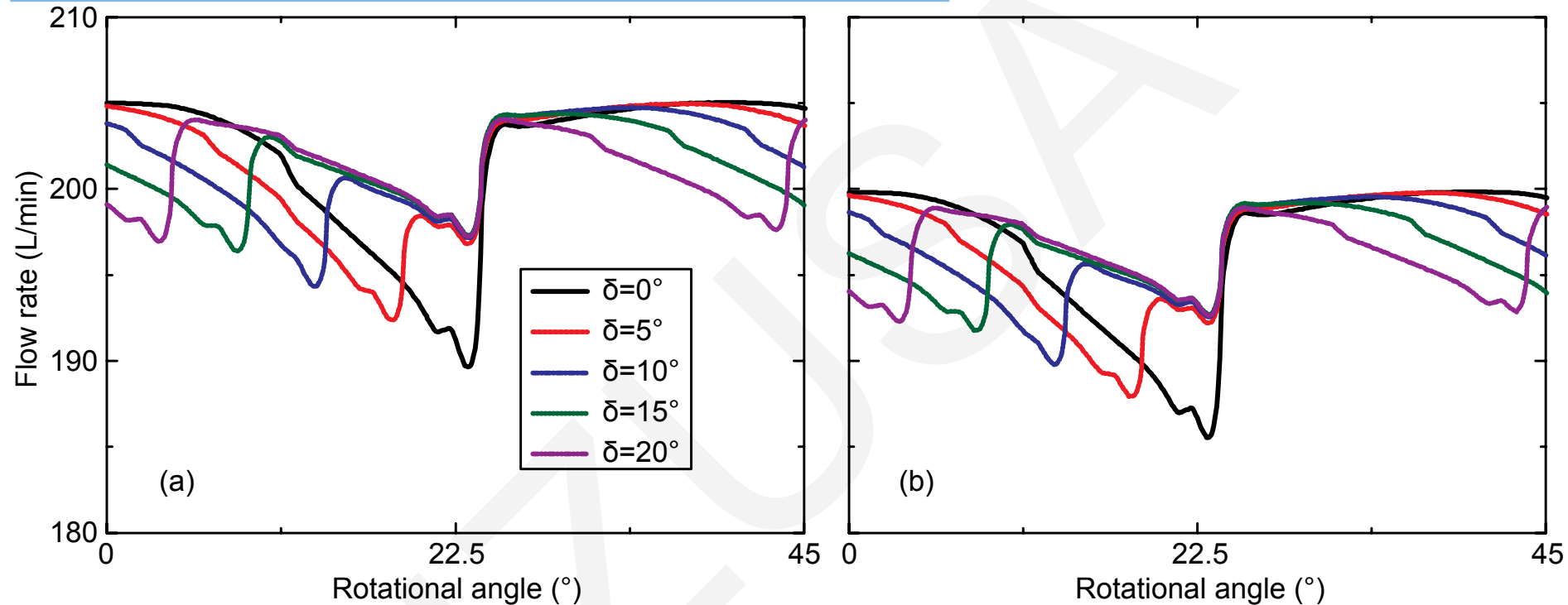


Variations in flow ripple

- Frequency domain;
- Twenty harmonics;
- Phase difference.

- Odd harmonics can be cancelled out;
- Reduce the flow ripple components.

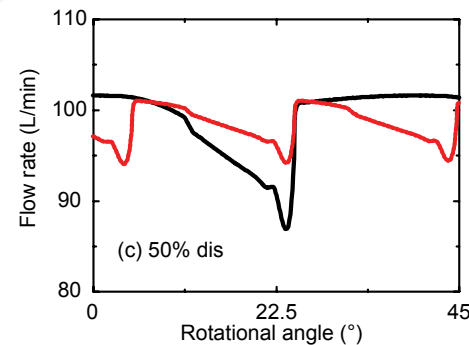
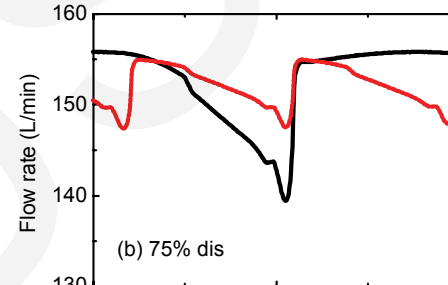
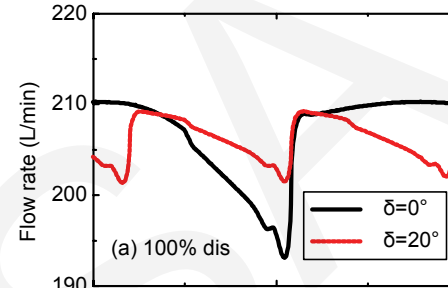
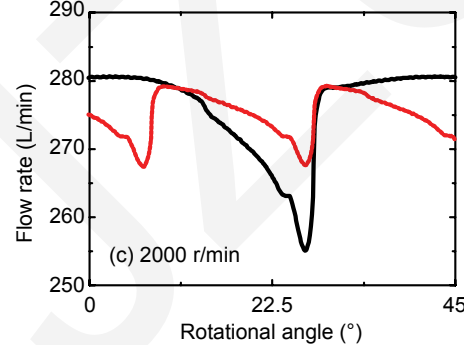
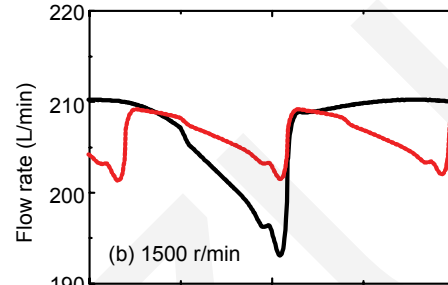
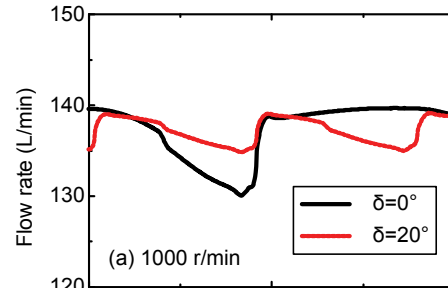
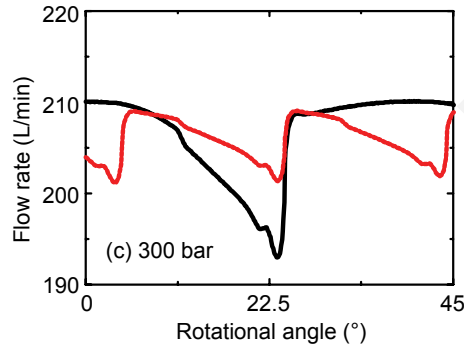
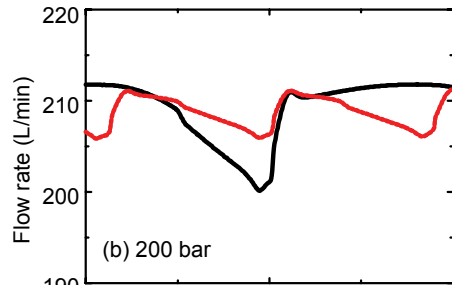
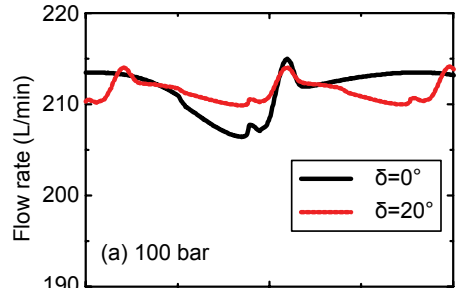
Sensitivity



Variations in flow ripple when displacements of the two rotating group are merely different

- Insensitive to displacement difference.

Sensitivity



Lower flow ripple at a wide range of working conditions.

Pressure levels

Revolution speeds

Displacement angles

Summary and outlook

- ◆ The flow ripple of a tandem axial piston pump was investigated;
 - ◆ The effects of index angle on the flow ripple is investigated;
 - ◆ The best index angle is 20° to reduce the flow ripple;
 - ◆ The reason is identified.
-
- ◆ Evaluation of airborne noise;
 - ◆ Experimental investigation.

Earlier publications

Ye, S.G., Xu, B., Zhang, J.H., 2014. Investigation into the effects of index angle on fluidborne noise and structureborne noise of a tandem axial piston pump. 8th FPNI Ph.D Symposium on Fluid Power, Lappeenranta, Finland, p.1-6. [doi:10.1115/FPNI2014-7815]

- ◆ A hybrid LP/FE model was developed to investigate the airborne noise;
- ◆ Fluid-borne noise sources decreases (the reason is unclear), whereas structure-borne noise sources increases.