A Hydraulic Hybrid Architecture combining an Open Center with a Constant Pressure System for Excavators

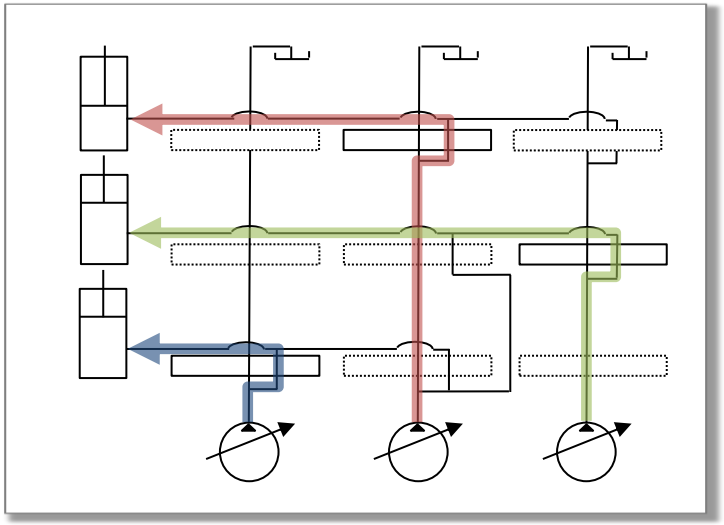
Hijikata Seiji

Contents

Introduction of Hydraulic Systems

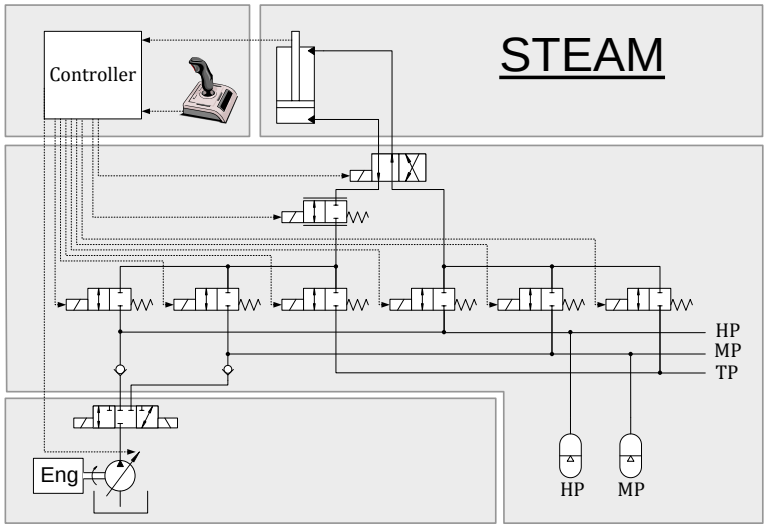
Reference

Three Pump Open Center System



- High efficiency of hydraulic system
- Energy can not be recuperated.
- Large idle losses

Constant Pressure System



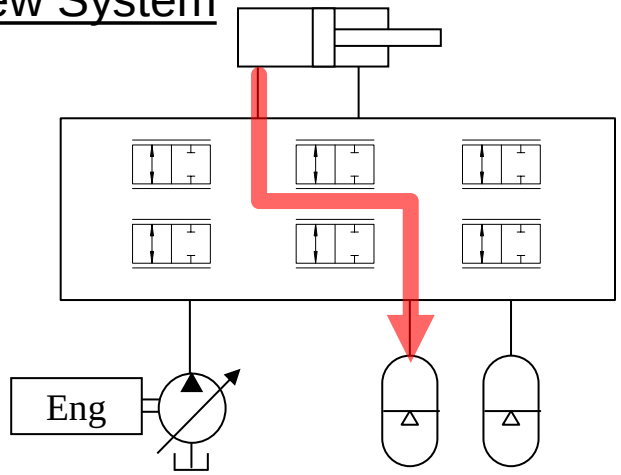
- High efficiency of engine operation
- Energy can be recuperated.
- Large number of the valves

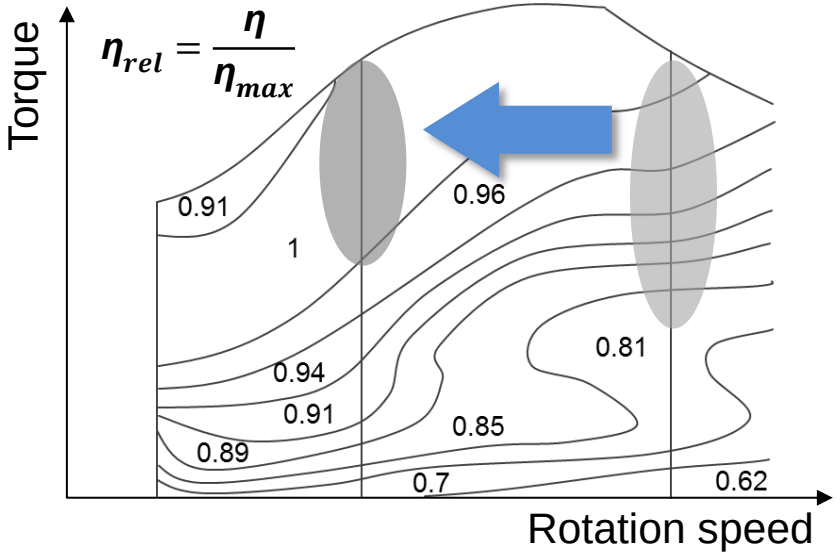
To design a new hybrid sytem which combines open center with constant pressure system

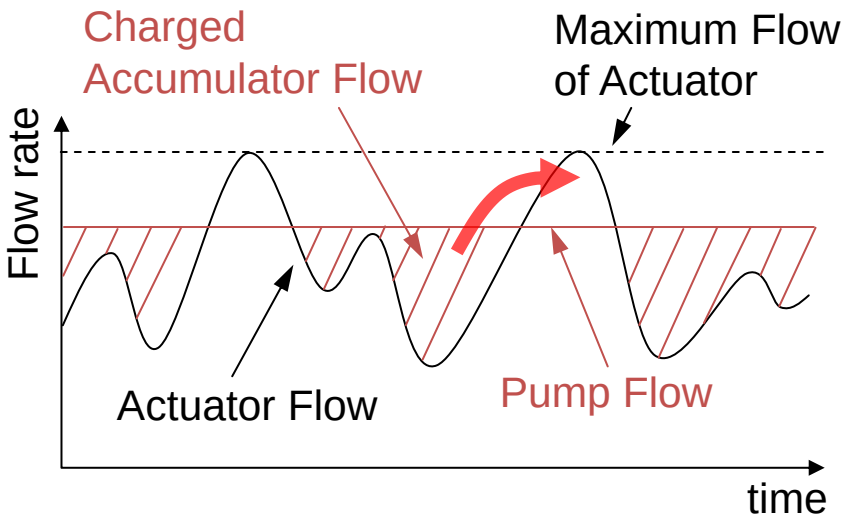
Contents

Basic Principles of New System

New System





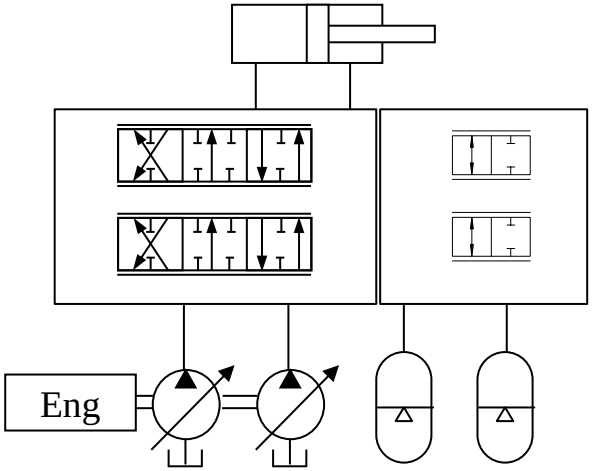


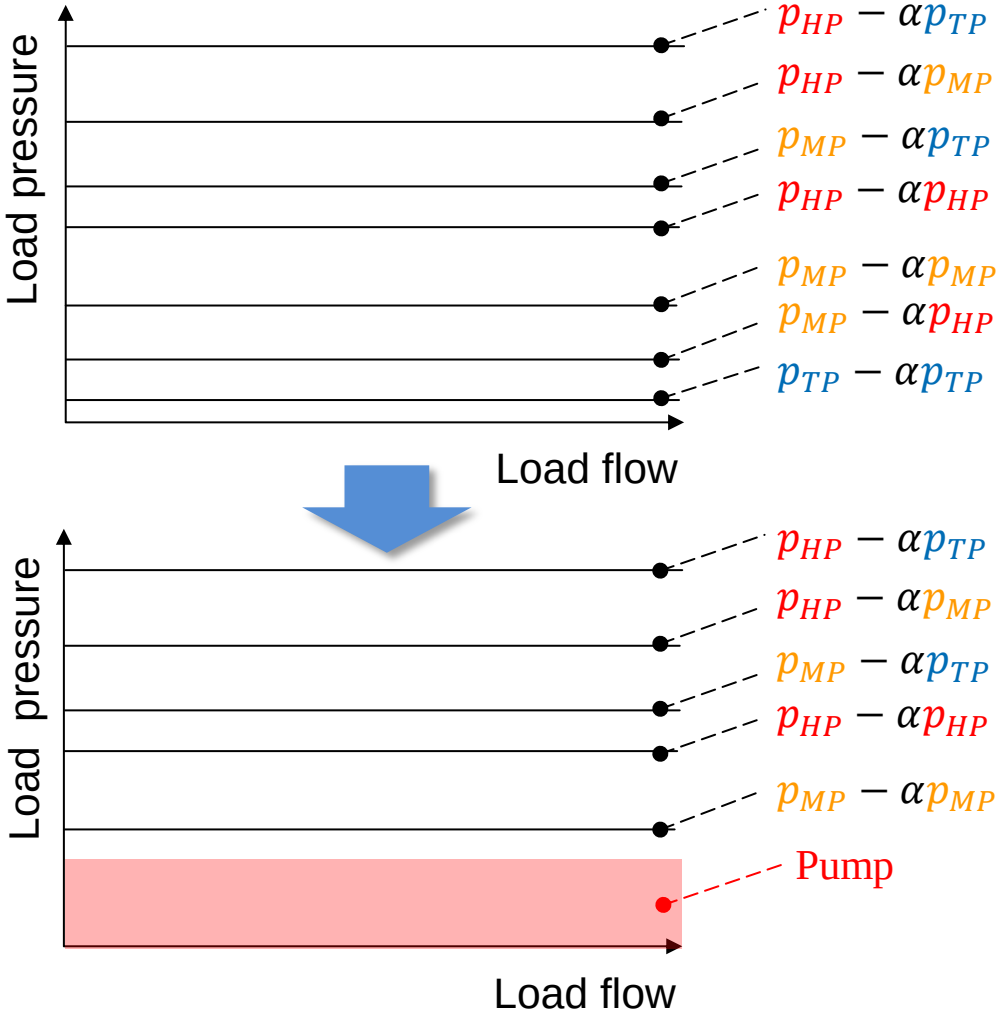
High efficiency engine operation

Recuperating energy

Basic Principles of New System

New System

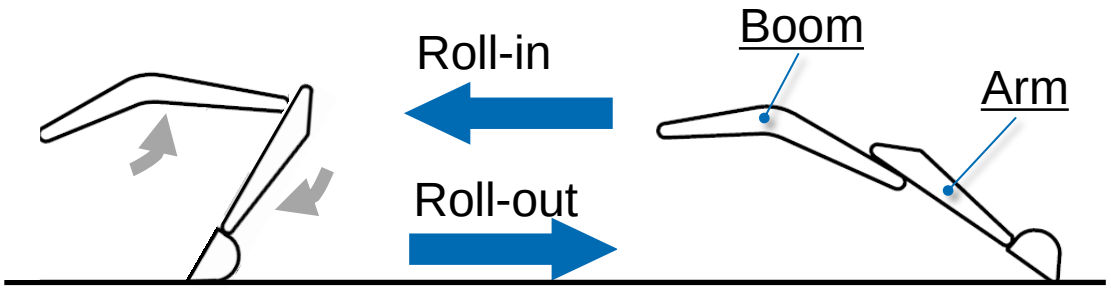




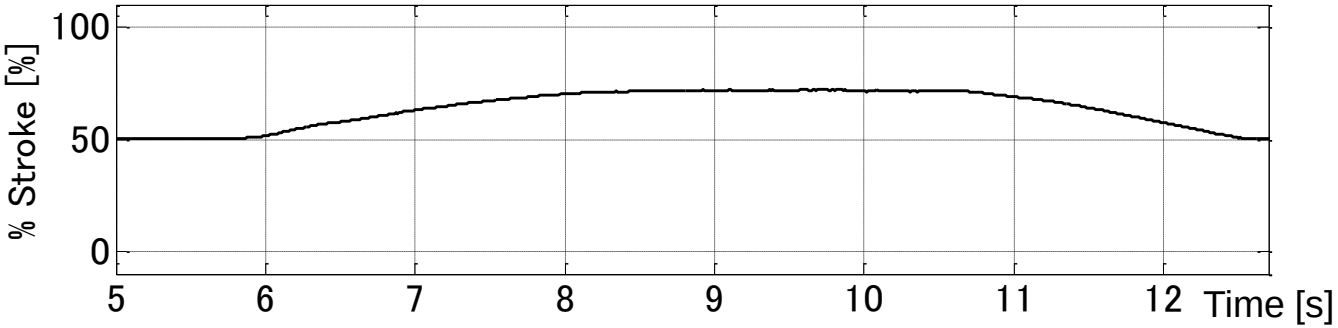
Flow rate is provided by pump directly.

2 pump open center valves are used.

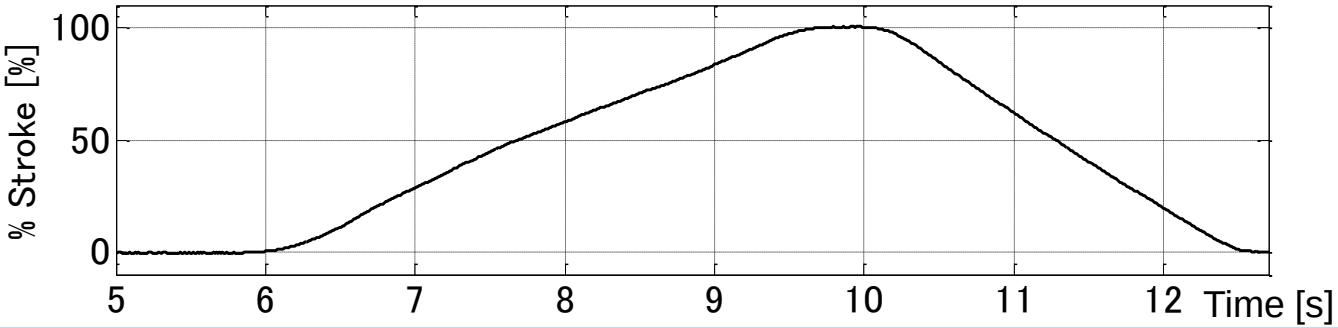
Levelling Cycle



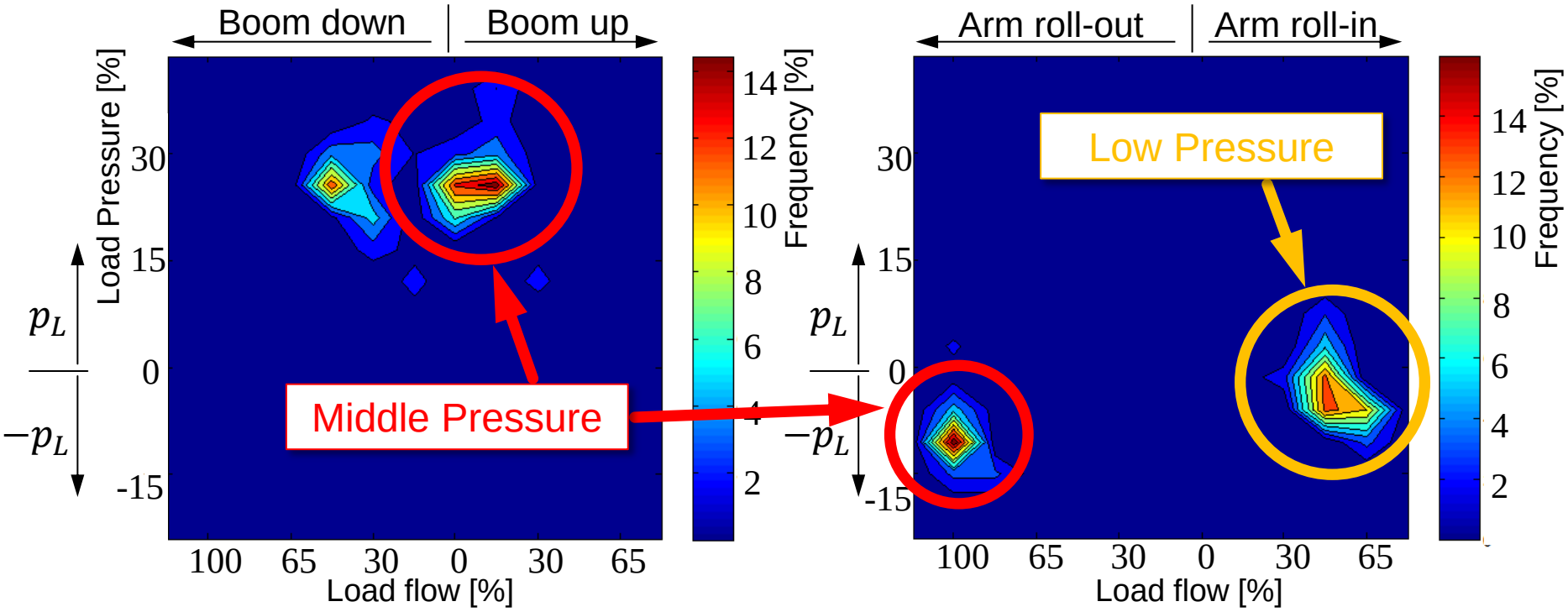
Boom



Arm

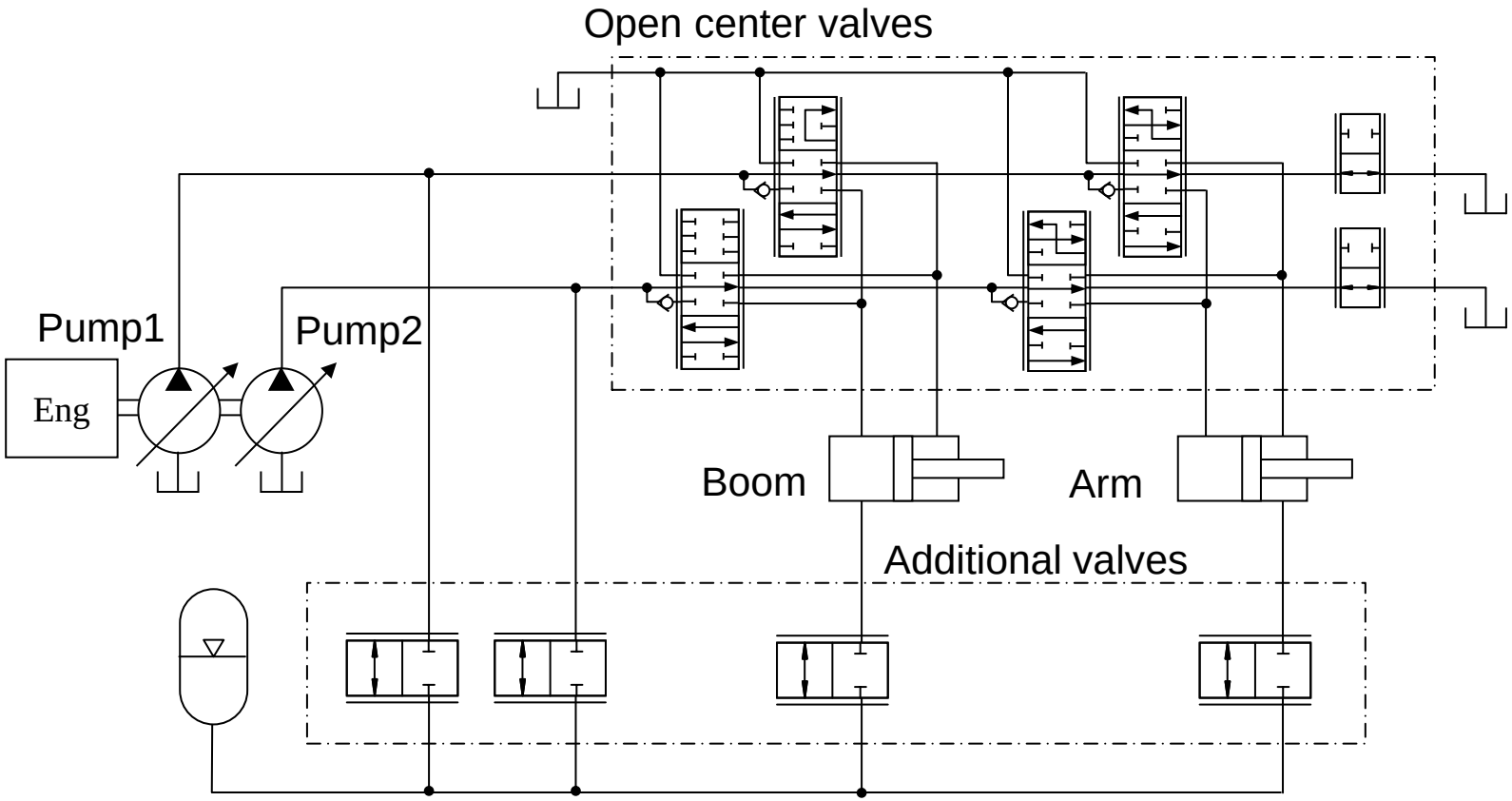


Data Analysis of Levelling Cycle



Motions	Pump1	Pump2	Accumulator
Levelling Roll-in	- Arm	- Arm	- Boom
Levelling Roll-out	- Accumulator charge	- Accumulator charge	- Arm - Boom recuperation

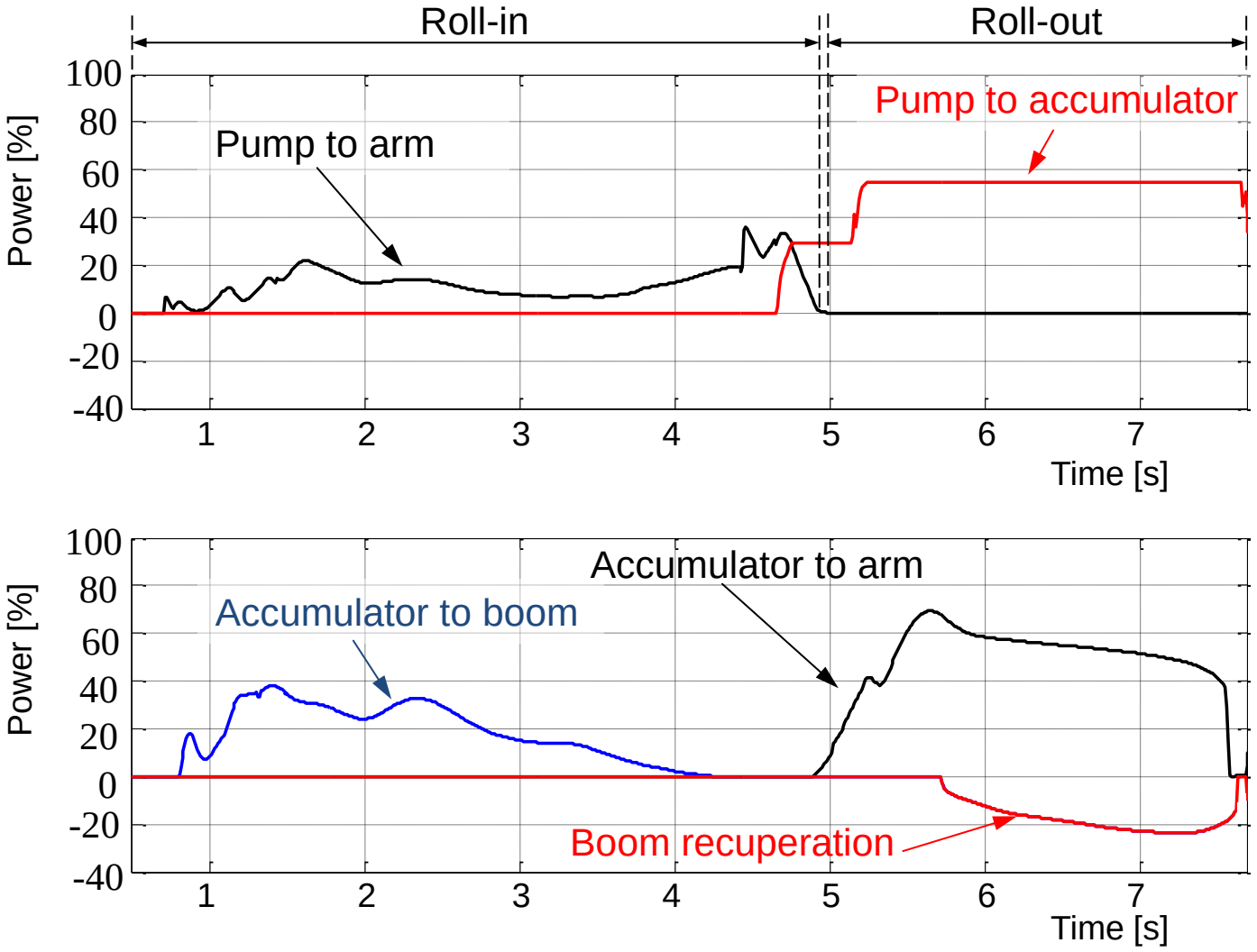
Hydraulic Circuit of New System



The number of valves can be reduced by using the open center valves.

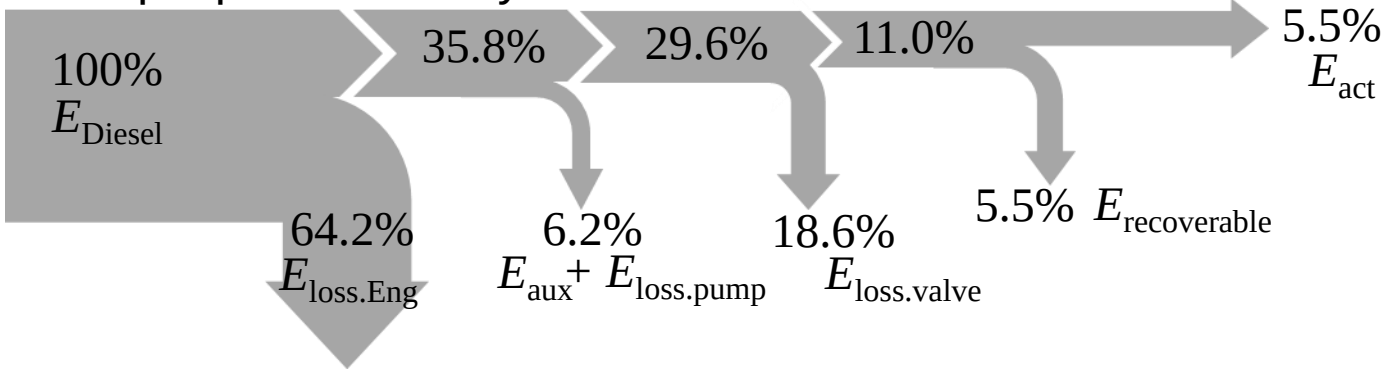
Contents

Simulation – Cycle Power Analysis

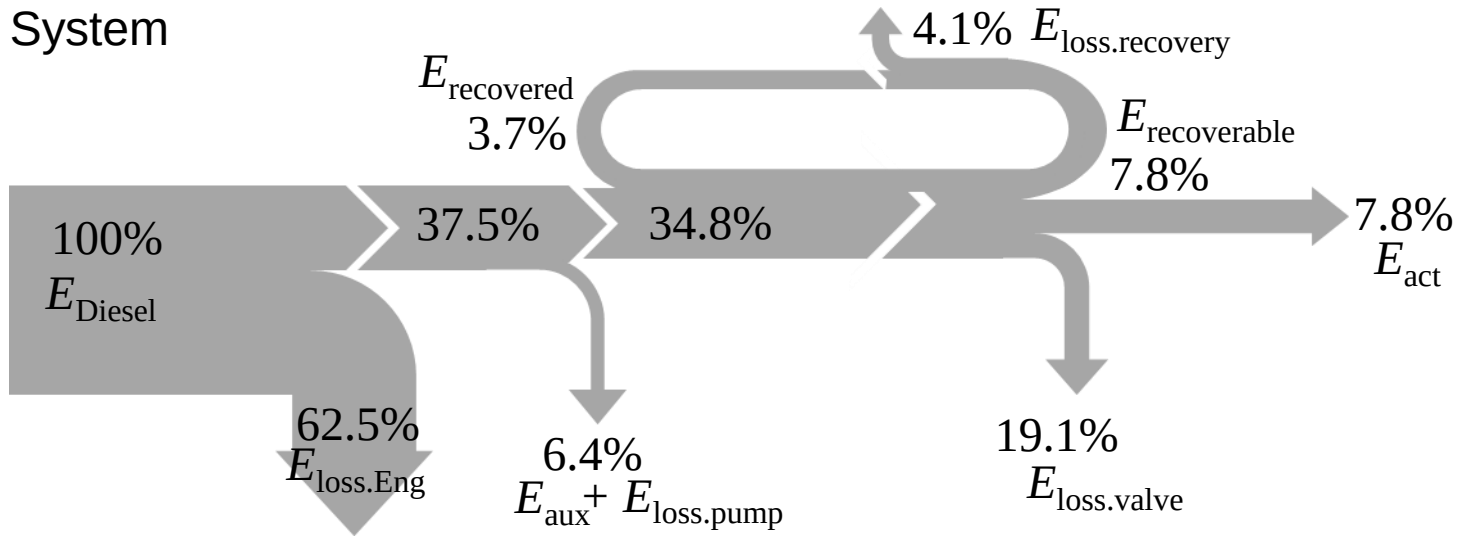


Sankey Diagram for System Efficiency

- Three Pump Open Center System

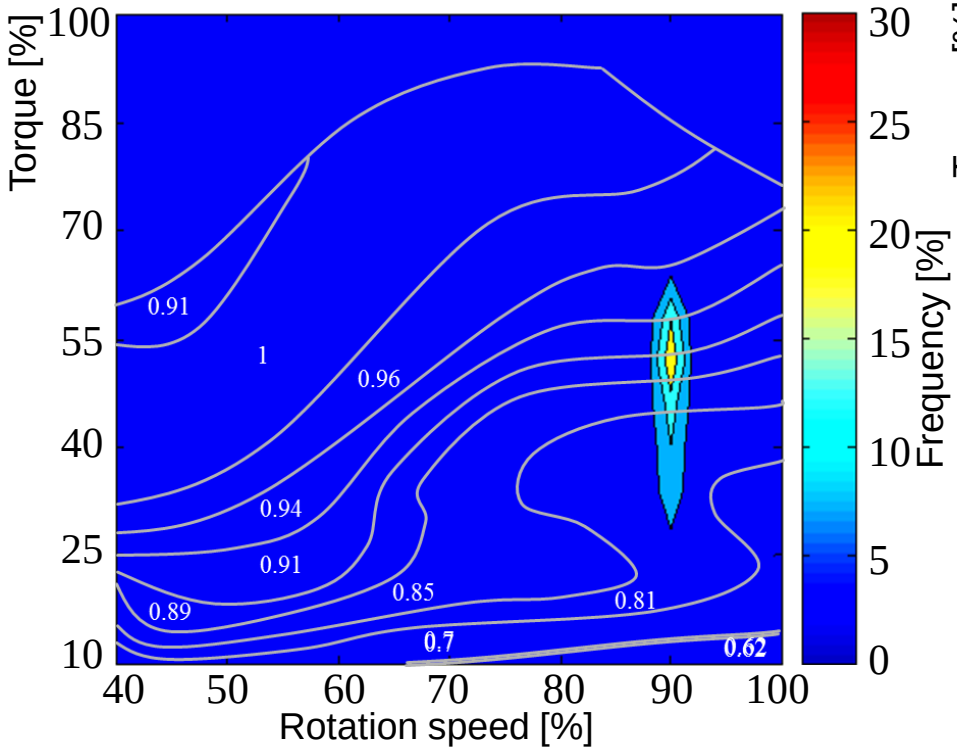


- New System

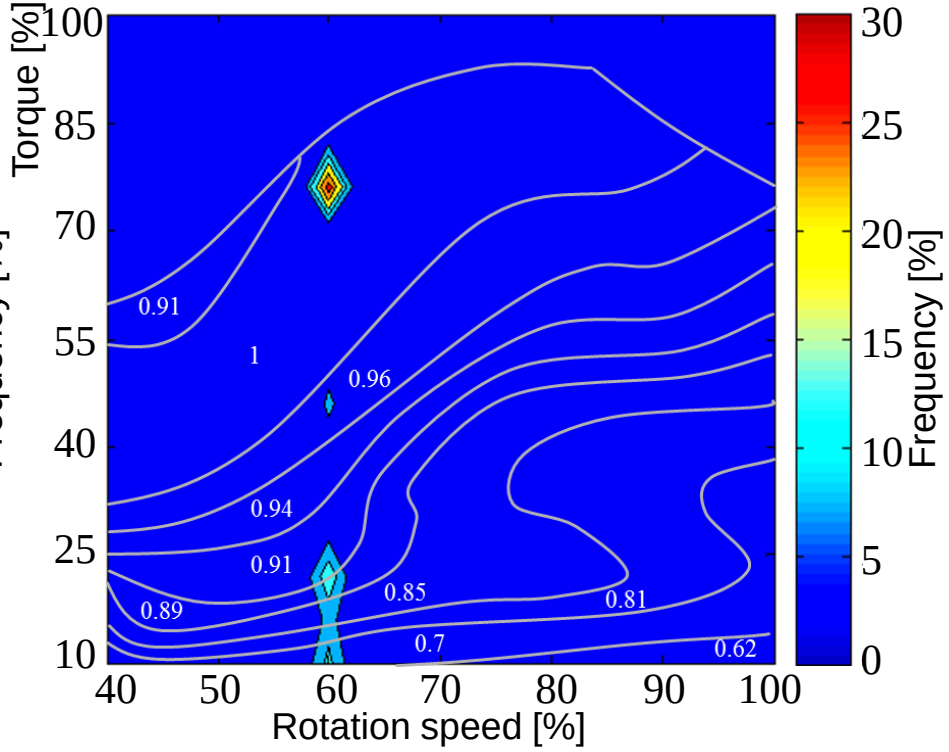


Engine Operation with Efficiency Map

Three Pump Open Center System



New System



The new system shows potential 30 % less fuel compared to three pump open center system.

Contents

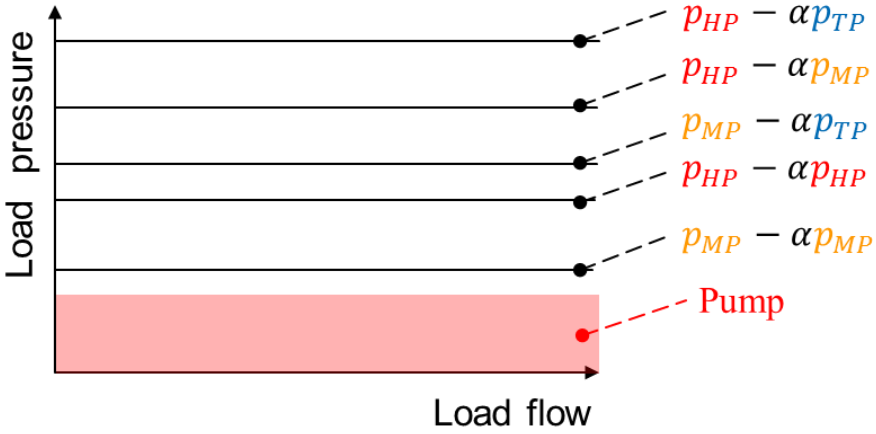
Conclusion and Outlook

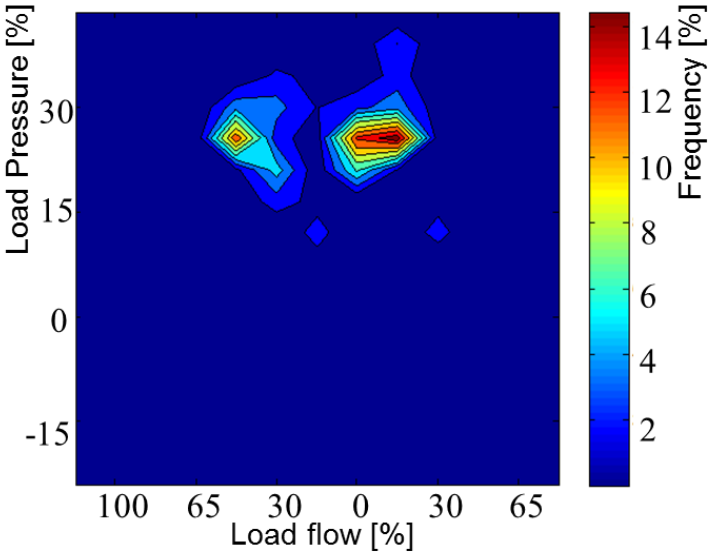
Conclusion

- Basic principles for the new system was shown with analysis of measurement data.
- The hydraulic circuit for the new system was explained.
- The new system has consumed 30 % less fuel than three pump open center system.

Outlook

- Experiments will be conducted with a test rig.





Thank you for your attention!

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