Positive flow control of closed-center electrohydraulic implement-by-wire systems for mobile equipment applications

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Abstract

Digitally controlled electrohydraulic (EH) closed-center valves and load sensing hydraulic pump systems have been quickly replacing the older generation of hydro-mechanically controlled (pilot actuated, mechanically controlled) open-center valves and fixed displacement pump systems in mobile equipment applications such as earth moving and construction equipment (i.e. wheel loaders, excavators, harvesters).

With carefully designed and coordinated motion control systems, the power efficiency of the hydraulic system can be improved using closed-center EH systems to the point that significant fuel savings can be achieved. Furthermore, the machine behavior can be optimized for different applications via real-time control software. Such capabilities were not possible in hydro-mechanically controlled systems. Energy efficiency, high performance, software based re-configurability and reliability are the main objectives in design of EH systems for mobile equipment applications.

Author Keywords: X-by-wire control systems; Implement-by-wire; Positive flow control (PFC); Electrohydraulic (EH) two-stage proportional valve; Variable displacement pump; Wheel loader (WL); Construction equipment