Energy Efficiency Improvement of Excavator with Independent Metering Valve by Continuous Mode Changing Considering Engine Fuel Consumption

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Abstract : Hydraulic system of excavator gets working energy from hydraulic pump which is connected to output shaft of engine. Recently, main control valve (MCV) which is composed of several independent metering valve (IMV) has been introduced for better energy efficiency of the hydraulic system so that fuel efficiency of the excavator can be improved. Excavator with IMV has 5 operating modes depending on the quantity of regeneration flow. In this system, the hydraulic pump is controlled to supply demanded flow which is needed to operate each mode. Because the regenerated flow supply energy to actuators, the hydraulic pump consumes less energy to make same motion than one that does not regenerate flow. The horse power control is applied to the hydraulic pump of excavator for maintaining engine start under a heavy load and this control makes the flow of hydraulic pump reduced. When excavator is in complex operation such as loading or unloading soil, the hydraulic pump discharges small quantity of working fluid in high pressure. At this operation, the engine of excavator does not run at optimal operating line (OOL). The engine needs to be operated on OOL to improve fuel efficiency and by controlling hydraulic pump the engine can drive on OOL. By continuous mode changing of IMV, the hydraulic pump is controlled to make engine runs on OOL. The simulation result of this study shows that fuel efficiency of excavator with IMV can be improved by considering engine OOL and continuous mode changing algorithm.

Keywords : continuous mode changing, engine fuel consumption, excavator, fuel efficiency, IMV
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