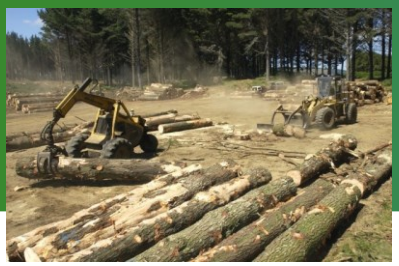

HARVESTING TECHNICAL NOTE

HTN06-08
2014

Outhaul Distance Measurement

Summary

Measuring main rope out distance as a proxy for outhaul distance is a feature of some new harvesting machines and equipment. This approach has the potential to improve productivity through faster outhaul and more accurate location of grapples, rigging or other equipment. The current state of outhaul-distance measurement was reviewed. Global positioning systems (GPS) have been adopted as a non-contact solution for carriage location and positioning. Encoders and proximity sensors have found application in situations where the number of drum rotations can be used as a surrogate for distance. They also provide information on drum speed, and how much more rope is remaining on the winch drum.

Tony Evanson, Scion

INTRODUCTION

A project was initiated in 2010 by Future Forests Research Limited (FFR) to improve the productivity and safety of the extraction phase of grapple yarding through improving grapple carriage control systems.

One of the developments initiated by FFR has been the introduction of the Alpine Grapple carriage from South Africa, and further modification of this grapple carriage for New Zealand cable logging operations. Other New Zealand companies have responded to the challenge of improving the safety and productivity of steep country logging by developing their own hauler equipment, such as the Falcon Forestry Claw[1] developed by DC Repairs Ltd based in Nelson, and the ACDAT hauler management system[2] developed by Active Equipment Ltd in Rotorua.

The effective control of rigging or carriages requires real-time location information (that is, 'main rope out distance' or carriage position) that can be used by the hauler operator. Once displayed, understood and applied, this information can reduce outhaul and rigging or grapple placement time. Displaying 'main rope out distance' may also be used to position rigging or carriages to breakout sites that the hauler operator cannot see, although the operator is often assisted by a 'spotter' or breaker out. It should be noted that, for safety reasons, rigging positioning is ultimately the responsibility of a breaker out.

METHOD

This topic was initially examined in 2009[3] and is now being revisited, as there have been recent developments. Information from previous reports, and recent industry developments, were reviewed and are summarised here.

RESULTS

Various methods of measuring 'main rope out distance' have been used in the past. For example, European haulers, such as the Syncrofalke hauler[4, 5] have a main rope distance and speed display system (Figure 1).

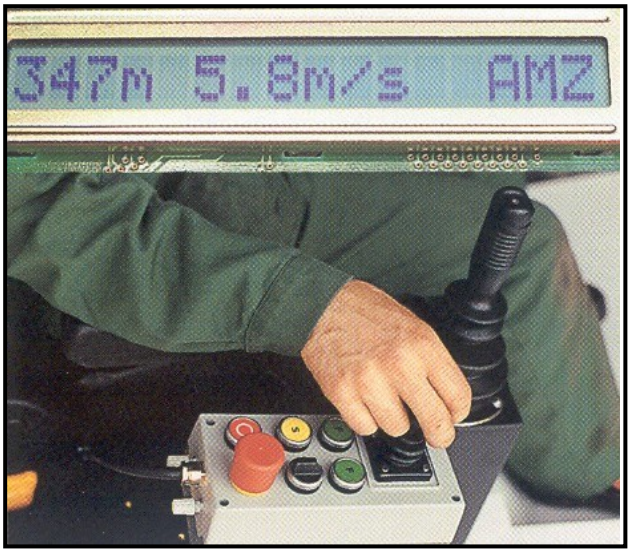

Figure 1: Syncrofalke hauler control system and display.

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The hauler drums are alternately controlled by the operator and the breaker out. The system used for sensing distance is not known, but probably involves a sheave-mounted encoder.

The 'traditional' method is the hauler operator looking down at the main rope or tail rope drum and noting the rope lay point on the side of the drum when the rigging is positioned for hooking on a drag. The operator watches the drums as the rigging is outhauled and stops the drums as the lay point is reached.

Another method used has been the installation of magnets or nuts to the side of the main rope drum (Figure 2). The magnets/nuts are 'read' by a proximity sensor. The number of rotations is counted by the sensor and displayed in the cab (Figure 3). Several New Zealand contractors have installed this technology. Some contractors have used it to measure and display both skyline movement and main rope out rotations[6] The cost for single drum counter system hardware (excluding the fitting of the sensors and wiring) is quoted at $980 + GST.

Figure 2:. Proximity switch or sensor mounting for a counter. (Photo: Bill Winmill)

The use of magnets and Hall-effect sensors to measure main rope out has limitations. This is because relating drum rotation to rope out is complicated by the changing effective rope/drum diameter as well as rope diameter and wear. If drum rotations only are displayed rather than distance in metres, this can be used to locate the rigging.

Figure 3: 'Anything Electronic' Cable counter display.

Different methods are in use in other industries such as fishing, oil exploration and cranes. Fishing trawlers can be equipped with sheave systems (Figure 4) that record the length of trawl-net wire rope deployed.

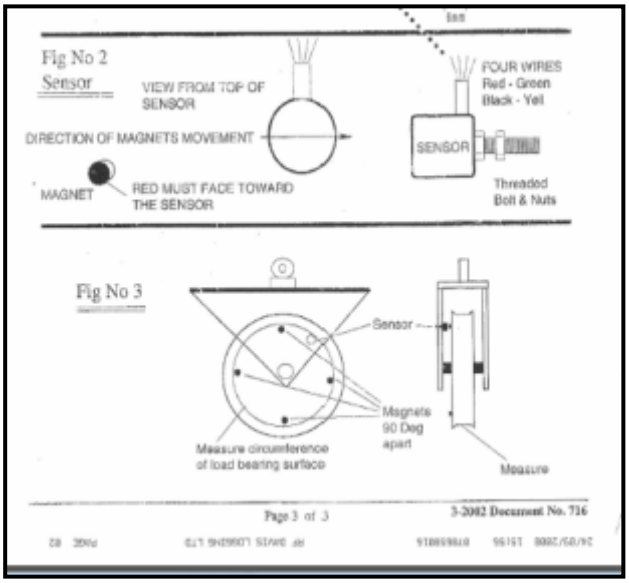

Figure 4: Schematic for a Kortz[7] trawler cable counter.

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More complex fixed systems are used to control large floating barges or platforms by ships. Running-line tension monitors that can be used with cranes, such as the Scotload[8] which measures tension, rope speed and distance (Figure 5), have integrated line-out measurement by encoder sheaves. The price for the Scotload is £4,137 excluding freight. Some other systems also allow for radio links to displays.

Figure 5: Scotload running-line monitor which measures tension, rope speed and distance.

Global Positioning Systems (GPS)

Recent 'main rope out distance' measurement has been achieved by the use of GPS software incorporated into camera systems offered by DC Repairs Ltd of Nelson. The cost of such a system is approximately $8,500 as an add-on option for a grapple carriage, and $10,500 as an add-on option to a grapple.

Carriages such as the Falcon Forestry Claw and Alpine Grapple carriages are equipped with both a camera and a GPS. The operator can read the last distance to the breakout site, then use that information to outhaul the carriage close to that point before using the camera for the final positioning. Global positioning systems are now a widely used technology for location and measurement. The accuracy of GPS is affected by a number of factors, including the availability and number of satellites used. Results using modern Garmin handheld GPS units (Garmin 64 series) suggest that GPS is sufficiently accurate to locate a position to within 2 to 3 metres (Rod Brownlie pers.com). This level of accuracy is likely to be sufficient when used in conjunction with a camera, or aided by visual location to be useful in field operations.

Winch-assisted Systems in New Zealand

Winch-assisted systems have been developed by a number of innovative New Zealand companies, and also by individual contractors. One particular system (Figure 6) comprises an excavator-mounted winch drum that assists the traction of a felling or bunching machine. The system uses a wheel encoder to measure winch drum speed. The information is carried by radio link to the winch-assisted machine.

Figure 6: Wheel encoder mounted on a winch drum – winch-assisted machine. (DC Repairs Ltd)

CONCLUSIONS

Determination of 'main rope out' or 'outhaul distance' and the location of the carriage can be achieved by measuring drum rotations or the length of rope paid out. This has been done in harvesting operations by using encoders, sensors or by GPS. Global positioning systems have been adopted as a non-contact solution for carriage location and positioning. Sensors have found application where number of drum rotations can be used as a surrogate for distance in metres, and provide information on rigging or drag location as well as skyline drum position.

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