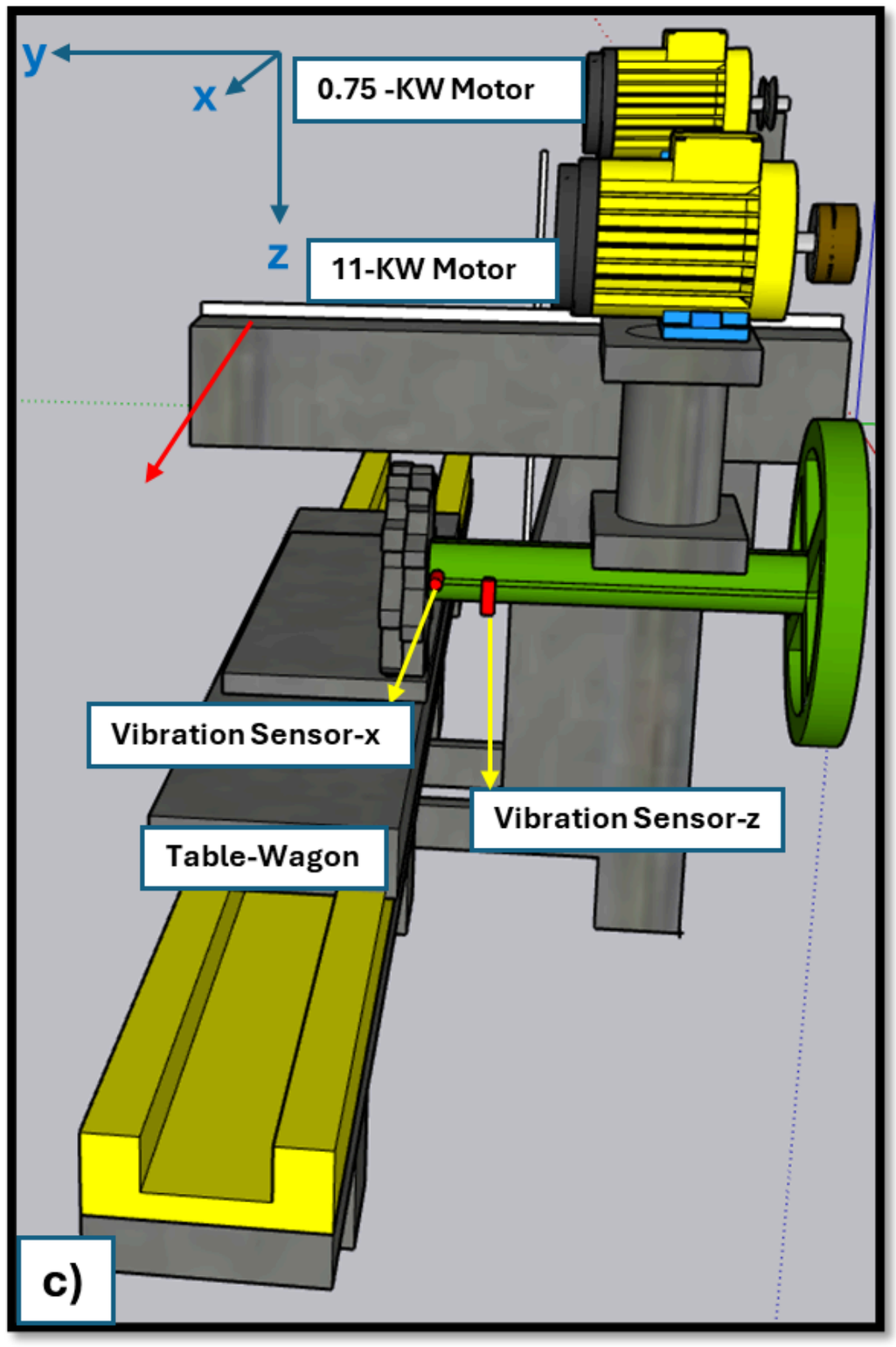
DEPARTMENT OF MINING ENGINEERING

13 OCTOBER 2025

ANABILIM DALIMIZDA DOKTORA TEZ SAVUNMA SINAVI

ABDOLSATTAR ROUDINI



CUTTING PERFORMANCE OPTIMIZATION OF LABORATORY SCALE ROTARY ROCK CUTTING HEAD BY APPLICATION OF MACHINE LEARNING METHODS

This thesis develops and validates a data-driven framework to lower specific energy (SE) and vibration in boom-type roadheader cutting. A laboratory-scale rotary head rated at 11 kW and ≈22.5 cm radius, equipped with 80° cone-angle conical picks, cut concrete mixes representing three strength classes under unrelieved conditions using a full factorial 3×3×3 design with 27 runs executed in triplicate per mix for a total of 243 cuts. Power, traverse speed, bi-axial vibration in X and Z, and the realized depth of cut were recorded. The machine-frame X axis consistently exhibited the largest vibration, and two thresholds t_1 ≈ 88 mm/s and t_2 ≈ 146 mm/s partitioned vibration in a manner consistent with material strength. Supervised modeling linked set points to performance. For SE, tree ensembles achieved cross-validated R^2 of approximately 0.93 to 0.97, with depth as the primary driver. For vibration in the X direction, cross-validated R^2 ranged from about 0.32 to 0.65, with depth again primary and rotational speed secondary. A constrained particle swarm optimization produced implementable recommendations, and under balanced weights representative settings were depths of about 5.1, 5.9, and 8.0 mm, cutterhead tip speed 4.17 m/s, and table speed 187 cm/min. These results support adaptive, vibration-aware selection of operating parameters.

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TOPLANTI SALONU: (KTÜ) MÜHENDISLIK FAKÜLTESI DEKANI

Toplantı Linki

Tüm öğretim üyeleri ve öğrenciler tez savunma sunumuna davetlidir.