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Predictive Maintenance of Industrial Shredders: Efficient Operation through Real-Time Monitoring Using Statistical Machine Learning

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Abstract : The shredding of waste materials is a key step in the recycling process towards the circular economy. Industrial shredders for waste processing operate in very harsh operating conditions, leading to the need for frequent maintenance of critical components. Maintenance optimization is particularly important also to increase the machine's efficiency, thereby reducing the operational costs. In this work, a monitoring system has been developed and deployed on an industrial shredder located at a waste recycling plant in Austria. The machine has been monitored for one year, and methods for predictive maintenance have been developed for two key components: the cutting knives and the drive belt. The large amount of collected data is leveraged by statistical machine learning techniques, thereby not requiring very detailed knowledge of the machine or its live operating conditions. The results show that, despite the wide range of operating conditions, a reliable estimate of the optimal time for maintenance can be derived. Moreover, the trade-off between the cost of maintenance and the increase in power consumption due to the wear state of the monitored components of the machine is investigated. This work proves the benefits of real-time monitoring system for the efficient operation of industrial shredders.

Keywords : predictive maintenance, circular economy, industrial shredder, cost optimization, statistical machine learning
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