Modeling the Grain Handling System on a Combine Harvester using the Discrete Element Method

Eric Veilke
CNH America LLC, USA, eric.veilke@cnh.com

Written for presentation at the
CSBE/SCGAB 2013 Annual Conference
University of Saskatchewan, Saskatoon, Saskatchewan
7-10 July 2013

ABSTRACT Discrete element method (DEM) simulation is a numerical method of quantifying the forces and motion of a large number of small particles. Developments in recent years have increased the viability of using DEM simulations to predict the performance of grain handling systems. The grain handling system on a combine harvester performs a critical function - removing grain from the cleaning system and transporting it to a temporary storage tank and eventually removing it from the harvester. The combine harvesters produced by Case Hew Holland (CNH) typically have a grain conveying system that includes elevators and screw augers. Historically, the development of grain handing systems typically used to take weeks to months to complete. With the use of DEM simulations the timeline can be shortened to days or even hours. Just like field or laboratory tests, DEM simulations can be used to quantify the grain handling system capacity and power requirements. In addition, DEM simulations can be used to quantify the amount and location of kernel damage caused by the grain handling system. The signal from grain mass-flow sensors can even be predicted with DEM simulations to ensure that the sensor can accurately predict the grain flow in the system. The error in predicting a grain handling system capacity and power requirements is in the range of 5%. The use of modern DEM simulations are a smart alternative to historical development techniques of grain handling systems.

Keywords: Discrete Element Method, Combine Harvester , Grain Handling, Power, Capacity, Kernel Damage, Yield Sensor