بررسی تأثیر دمنده کمباین در تحلیل و افت واحد تمیز کننده با استفاده از دینامیک سیالات محاسباتی

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چکیده

در کمباین جاندیر ۵۵-۱۰ دور دمنده را می توان بسته به نوع محصول و شرایط برداشت از ۲۴۰ rpm تا ۱۰۶۰ rpm تنظیم کرد. پروفیل جریان هوای دمیده شده روی الکها و تأثیر آن بر روی دانه های گندم اهمیت دارد. در این مقاله پس از نصب حسگر باد سنج در قسمت بالایی الکها با تغییر دور دمنده و زاویه صفحه منحرف کننده میزان سرعت جریان هوا در نقاط مشخص شده در دو حالت شرایط کاری و بدون بار از کمباین اندازه گیری و به عنوان ورودی نرم افزار فلوئنت قرار گرفت. اندازه گیری سرعت هوا روی الک کلش در سه دور مشخص دمنده به ترتیب ۳۴۰، ۶۰۰، ۱۰۰۰ rpm و سه وضعیت صفحه منحرف کننده °۱۵، °۳۰ و °۶۰ نسبت به افق صورت گرفت. در مش بندی طرح مربوطه از المان های سه وجهی مثلثی به تعداد ۴۱۴۴۰ و در شبیه سازی نرم افزار فلوئنت از مدل حل شرط پایدار و مدل ویسکوز RNG k-ε استفاده شد. برای حل مسئله از شروط و قیود مرزی سرعت ورودی، خروجی جریان، دیواره متحرک، از حالت مولتی فاز برای شرایط کاری و در کل تحت شرایط محیط متخلخل بهره گرفته شد. در پایان پس از تحلیل نرم افزاری و مقایسه مقادیر واقعی اندازه گیری شده و حاصله از محیط نرم افزاری و نزدیکی این مقادیر، مقدار افت بهینه کمباین در سرعت پیشروی $3\ kmh^{-1}$، ۰/۴۱ درصد حاصل شد که نتیجه بدست آمده از محیط نرم افزاری در دور ۶۰۰ rpm و زاویه °۳۰ صفحه منحرف کننده را تأیید کرد.

کلمات کلیدی: *سرعت جریان هوا، شبیه سازی، صفحه منحرف کننده، فلوئنت*

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Investigating the Effect of Combine Blower on Analysis and drop-cleaning unit using computational fluid dynamics (CFD)

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Abstract

Cleaning unit is one of the most important parts of a combine. This has a significant impact on the quality of crushing, the grain losses and combines performance is. The cleaner unit consists of a number of perforated sheets and a fan. Combine fan speed depending on the crop and harvest conditions can be adjusted from 340 to 1060 rpm. The air stream blown onto the honeycombs is important and it affects the losses of wheat harvested. Due to the high repeatability and excellent visualization, the computational fluids dynamics can be used to study and simulate the airflow on the sieve And a suitable pattern of air flow which reaches its minimum grain loss per unit Cleaner, forecasting and simulation. And a suitable pattern of air flow which reaches its minimum grain loss per unit cleaner, forecasting and simulation. In this research, JD-1055 combine model made in Iran, were used. The flowmeter sensor was installed in the upper part of the grid plate and by changing the fan and the angle of the deflection plate; the air flow velocity was measured at the points marked on the sieve (first, middle and end). To record the data, the Prova AVM-07 Flowmeter was used with a precision of 0.1ms-1 (Fig. 1). The speed of air on the grille plates was measured in three rounds of 340, 600 and 1000 rpm fenders and three positions of 15, 30 and 60 degrees relative to the deflection plane horizons. This measurement was carried out in two modes without load and with loading from the combine. The values obtained were introduced as inputs of the fluent software. In the mesh, 41440 triangular elements were used and the Floating software simulation of the stable beta solution model and viscose model k-ε RNG were used. After designing, Meshiding the top of the sieve and obtaining data on load and no-load mode, fluent software simulation began. Flow chart for flow velocity during sieve for both load and no-load modes, Contour and vector air flow, For a 30 degree angle at 600 rpm for blower was assessed (Figures 5, 6, 7 & 8). The change of pace was also observed during the screening stubble (fig. 5-b). Where the speed is reduced at the end of the straw screening to the extent that this amount reaches its maximum at the end of 8.5 ms^{-1}. This value is close to the speed limit grain of wheat is preferred. The convergence diagram of the problem solves the simulation state (Fig. 7-b). The change of pace during screening stubble observed (Fig. 8-a). At 340 rpm, for the three modes of 15, 30 and 60 degrees deviation, the amount of cleaner losses was measured to be 0.35, 0.25 and 0.38 percent at a speed of 3kmh-1 (Table 2). Given that in this case, the blower speed and deflection plate, the amount of air velocity blown at the end of the combine is less than that of the wheat grain limit, The separation process does not take place well, and there is a high amount of impurities in the reservoir and the performance of the cleaning unit is not desirable. No significant difference was found between the measured values in both unloaded and loaded combinations and the values obtained from the software during the screening. This provides a good accuracy of computational fluid dynamics to express the exact behavior of fluids and air flow, especially in agriculture and in grain harvesters, for better analysis in terms of growth, development, and reduction of product crashes. After analyzing software and comparing the measured values obtained from the software environment and the proximity of these values, the optimum amount of combine drop was achieved at a velocity of $3kmh^{-1}$ and 0.41%, which confirmed the result obtained from the software environment at around 600 rpm and the angle 30 degree deflection plate.

Keywords: velocity air flow, simulation, deflection plate, Fluent
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