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Aerodynamic Effect of a Seam of Baseball

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All baseballs have seams, and they play a very important role in baseball games. The balls motion is affected by the seam. The most characteristic movement is called knuckleball, when the ball is shaking and dropping [1]. Some researches were done on baseballs in the past, but these researches did not focus on the seam height, width and shape. We are focus on a seam and doing numerical analysis on how the ball is affected by changing seam height, width and shape. The regulation size of the Nippon Professional Baseball (NPB) has a circumference of 229.0 to 235.0 mm, seam height of 0.9 mm and seam width of 0.8 (mm) [2]. Rubber baseballs which have vary size according to players age, is used in Japan [3]. The ball which classified in A-type ball is generally used by players who are older than a junior high school student. That specification is a diameter of 72±0.5 (mm) [4]. The present study was undertaken in order to analyse what kind of influence different seams have on a ball.

First, we used a three dimensional geometric designing software, SolidWorks, in order to make a baseball. One of the models that are designed by SolidWorks is shown in Fig. 1 below. As a standard model baseball conditions, we set the diameter of 72 (mm), seam height of 0.864 (mm), seam width of 7.776 (mm) and seam is all connected. Furthermore, we made another model ball with stitch and we made a domain around the balls for a uniform flow respectively. The model ball with stitch is shown in Fig. 2.

Next, the computational meshing around a baseball was made by ANSYS ICEM, which is the mesh making software. For precise analysis, a part of the seam was created with a thick mesh. And we used tetra mesh for the around region of baseball. The mesh around a standard model ball is shown in Fig. 3.

Finally, we used the numerical fluid analysis software, ANSYS FLUENT, in order to calculate the flow around the baseball. We calculated two balls which are standard model ball and model ball with stitch at same conditions. Fig.4 and Fig.5 show the results of calculation with an unsteady air flow and Table 1 shows the average value of results. These graphs show the value from 0.00 to 0.70 seconds.

As a result, the coefficient of drag was changed by seam shape. Furthermore, the values of aerodynamic coefficients were changed by time. From these results, the force that a ball

exerted by a flow is depend on a seam shape and time.
As the next stage, we are doing the calculation and experiment when the ball is rotating. Then, we will compare and explain the aerodynamic effect of a seam of baseball.

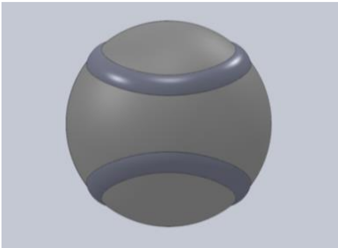
Fig. 1. Standard model ball

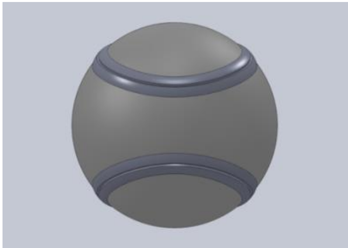
Fig. 2. Model ball with stitch

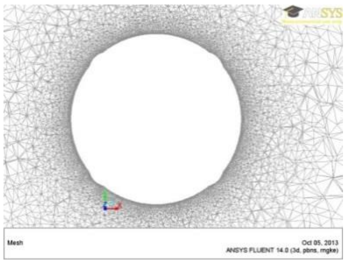
Fig. 3. Mesh around the standard ball

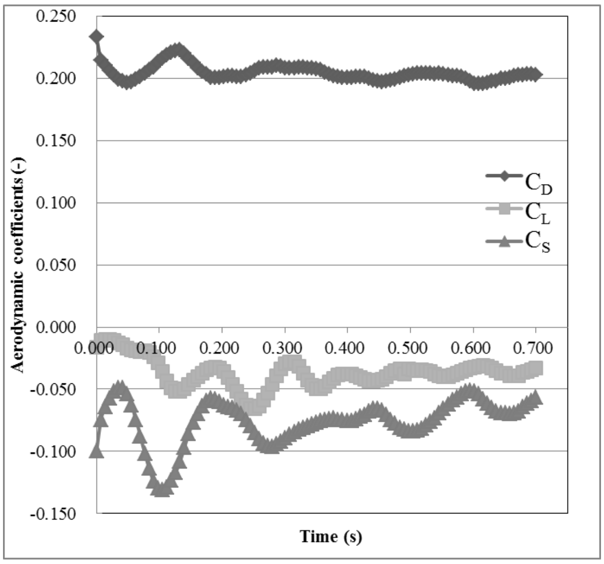

Fig. 4. Standard ball results

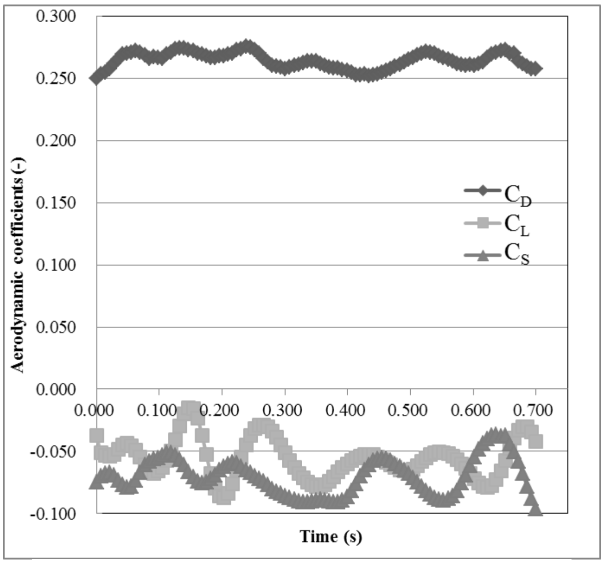

Fig. 5. Model ball with stitch results

Table 1 The avarage value of result

	C_D	C_L	C_S
Standard model ball	0.204	-0.037	-0.076
Model ball with stitch	0.264	-0.056	-0.070

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