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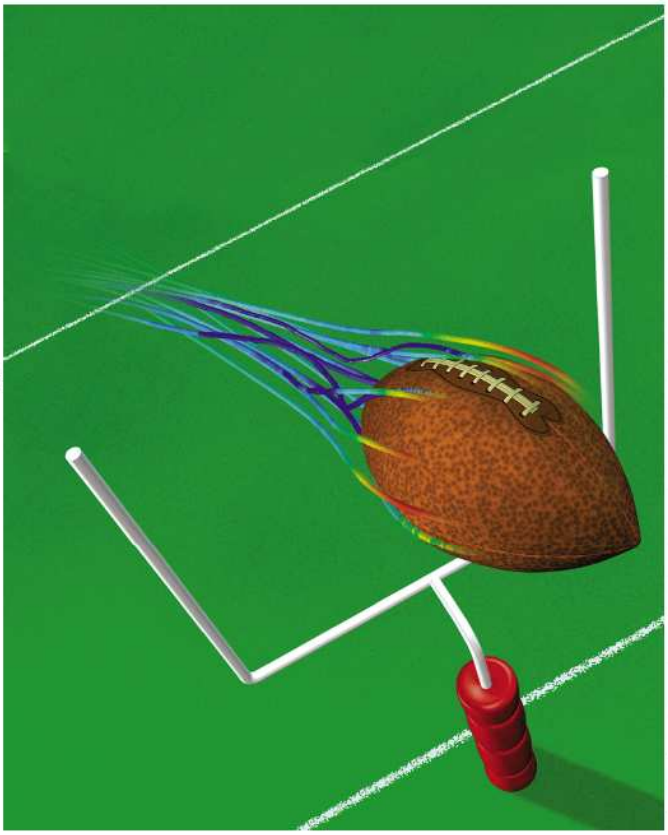
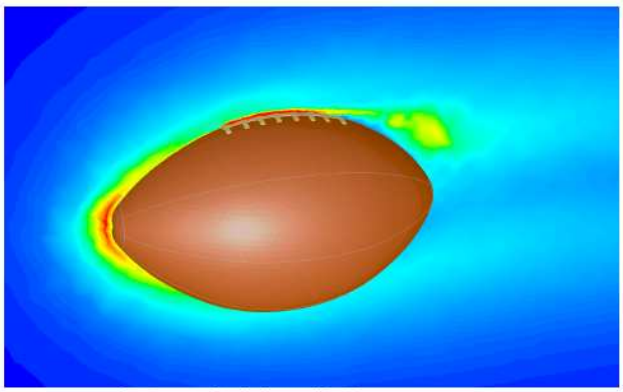
Laces Play an Important Role in Football Flight

While watching last winter's Super Bowl, the annual American football bonanza, some engineers from Fluent began to ponder the aerodynamics of a football in flight. They hunted down a regulation football, learning that the Canadian version is quite different from the American one, and modeled it in motion after a perfect throw. The perfect throw was assumed to give the ball forward motion only, with spin but without wobble. Their goal was to compute the forces and moments on the ball and understand the mechanics of the laces in disrupting the boundary layer.

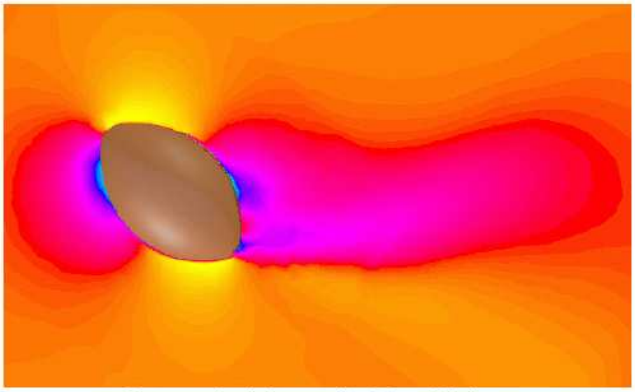
A sliding mesh model in FLUENT 5 was used for the transient simulation. One sphere was used for the outermost (free stream) boundary and another for the sliding mesh interface. A forward speed of 40 miles/ hour and a rotation speed of 300 rpm were assigned to the ball. Turbulence was incorporated through the use of the RNG model.



Results show a high pressure region in front of the ball with a long wake region behind it. The laces clearly cause the boundary layer to separate, and the separation region rotates with the ball. The predicted moments on the ball suggest that even though the ball is thrown straight, the rotation of the laces destabilizes the motion and causes the ball to begin wobbling. A second simulation of a kicked ball used an axis of rotation normal to the direction of travel. The fluctuating velocity field in front of and behind the kicked ball illustrate the inefficiency of this mode of transport.



Contours of turbulence kinetic energy show the disrupting effect of the laces



Contours of velocity magnitude for a kicked ball at one instant during the ball's rotation