

## **Abstract**

Egg incubators are essential equipment in poultry production, as the egg-turning process directly affects embryo development, hatchability rates, and production quality. At Aziza Hatcheries in Palestine, a problem was observed in the existing trolley connection mechanism of the Petersime incubator, resulting in differences in turning angles between consecutive trolleys connected to the same motion shaft. This problem led to inconsistent egg turning, reduced incubation efficiency, and potential financial losses.

The project focused on investigating the root cause of this problem and developing a practical solution to improve the accuracy and consistency of the turning system. Through field visits, measurements, and mechanical analysis, it was confirmed that clearance at the connection points between the trolleys was the primary cause of the angular deviation and the gradual reduction of the required turning angle.

Several solutions were proposed and evaluated based on technical, economic, and manufacturing considerations. The selected solution involved redesigning the female connection component using a hollow galvanized steel cylinder to reduce clearance and improve torque transmission between consecutive trolleys. The proposed design was modeled using SolidWorks software and verified through engineering calculations, weld analysis, and finite element simulation.

The component was manufactured using lathe machining operations and installed in a real operating environment at Aziza Hatcheries. Experimental results showed a significant improvement in turning-angle consistency, where the modified system achieved equal turning angles of approximately  $41^\circ$  between the tested trolleys, compared with the noticeable deviation observed in the original system. The proposed solution proved to be simple, reliable, economically feasible, and easy to manufacture locally, contributing to improved turning-system performance and reduced operational losses.