

Digital Transformation in Packaging

A component of any digital transformation strategy for packaging must leverage advances in the integration of advanced predictive computational methods, CAD generation, additive manufacturing, manufacturing/packing/filling line performance simulation, automated e-commerce "package system" evaluation technology and IoT focused near-real time security track/trace/notify. Although all these complementary technologies are not yet fully developed or "fully integrated" into a seamless execution process, they will be in the near future. In most cases these technologies have advanced to the point where the integration gaps can be navigated to create significant value via reduced cost, accelerated program schedules and reduced rework.



Individually these technologies are transforming the development of packaging. The power, yet to be fully realized, is evident when considering the advantages of their integration to create a near seamless development path. The core elements of the digital path for packaging include:

- Predictive Structural Computational Methods
 - *Predict conventional and e-commerce package performance: top load, package leakage, drop impact damage accumulation, pressure & vacuum resistance, sterilization efficacy, product compatibility, limited production trial (LPR) performance, long-term & short-term stacking test and distribution testing.*
- Manufacturing/Packing/Filling Line Performance Simulation
 - *Predict filling rate, foaming and packing line/product interaction.*
- Additive Manufacturing
 - *The revolution of what was once limited to a generic term of rapid prototyping, near production quality components can be manufactured quickly for evaluation.*
- CAD Generation
 - *Once the design has been converged upon based on performance requirements, automatically generate CAD to communicate the design to multiple suppliers for execution.*
- Automated E-Commerce "Package System" Evaluation
 - *An expansion of predictive computational methods, where modeling and simulation are used to predict the performance of a package when subjected to a test standard (such as ISTA 6-Amazon-OB), without prototyping.*
- IoT Focused Near-Real Time Security
 - *The integration of sensors into packaging, coupled with new data analytics, offers an opportunity to improve the consumer experience while gathering more data on demographics than ever before possible.*

Although the "digital transformation" is often represented as being something totally new, in reality, the core digital technologies for packaging and packaging systems emerged in the mid-1980s. Since that time the core technologies have been maturing, becoming more accurate, faster, easier to implement and, what has been needed the most, able to be integrated.

We can help you develop and execute a comprehensive digital strategy for packaging.

Any Bulging or Paneling Issues on Your Packages?

Dr. Jay Yuan, Principal at SES, presented at the Plastics Technology Conference ANTEC in Orlando a couple weeks ago. An overview of his paper follows.

"Bottle Internal Pressure Analysis and Testing for Hot Fill" (BIPATH) is a container, closure and process design and optimization program for packages that experience pressure or vacuum during any part of the supply chain. Originally developed for the hot fill PET bottle design, BIPATH has evolved and expanded to encompass a wide range of container types and pressure/vacuum-prone filling, processing and distribution systems. The container types include injection/extrusion blow-molded plastic bottles and cans, injection-molded or thermoformed tubs and cups, and aluminum and steel cans. The pressure/vacuum-prone filling, processing and distribution systems include hot fill, retort, high pressure process (HPP) sterilization, carbonation, nitrogen dosing, steam flushing, altitude and temperature change in distribution, air-shipping, product out-gassing or oxygen scalping, oxygen/CO₂ ingress or egress, and plastic creep deformation over time. BIPATH calculates the package allowable pressure, which is the pressure or vacuum that the package can sustain without any unacceptable deformations or distortions, and the package pressure residual, which is the pressure or vacuum generated inside the package. The ratio of the allowable pressure and residual pressure, known as package pressure safety factor, offers bottle suppliers and brand owners a simplistic way to measure how good (or bad) the package will perform. This predictive digital simulation technique can be completed during the early stages of the package and product development process since no physical bottle or finished good samples are required for the BIPATH program. The program enables pressure and vacuum optimization of the container, design, product fill height, process conditions (pressure, temperature and duration profiles), and shelf life. The validity and versatility of BIPATH program in managing the pressure and vacuum challenges has been demonstrated on real world packaging and process design and optimization problems since 2006. The theoretical foundation of the program and a case study are available upon request.

If you have any questions or would like a copy of the paper, please contact Dr. Yuan at 513-336-6701 or jay.yuan@stress.com.

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