STRESS ENGINEERING SERVICES INC.

STRESS? WE CAN HELP.

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Driving Sustainable Packaging for the Snack Food Industry

The snack food flexible packages on the market today, such as, potato chips, pita chips, taco chips, tortilla chips, etc. are typically sold by weight, that is, the packages need to fulfill the label claims by weight. However, the size of the package is determined by the overall volume of the products. The determination of the overall volume of a given product weight is not inconsequential. The volume is a function of broken chip rate, chip size distribution profile, bag width, bag film gage and material, production line speed (bag/minute), Vertical-Form-Fill-Seal (VFFS) machine type, etc. In order to minimize the risk of potential seal contamination-induced leakage, the bag size is, more often than not, larger than what it needs to be. In practice, this means more air and fewer chips in the package. For snack packages, the trucks are often cubed out by volume, not by weight. Energy is wasted in shipping as a result of excess air in the package.

The Stress Engineering team has developed a flexible chip bag filling simulation technology to help packaging engineers minimize material and pack-out volume to enhance sustainability in product distribution. This simulation technology to determine bag size was carried out by using a more realistic virtual simulation of the VFFS chip filling process, where the potential influential volume attributes could be modeled and their impact on the bag size quantified. This allows for a large number of simulated processes to run in considerably less time, thus eliminating the need for trial and error testing on the production floor. Coupled with this simulation, SES engineers are then able to conduct predictive analyses on fill height and required bag size, without slowing down production.

An example of this simulation focused on the funnel/forming tube, bag, and randomized falling chips in the funnel. It was progressed in three cases:

Case # 1: Filling whole chips into a round plastic tube
Case # 2: Filling whole chips into a flexible bag
Case # 3: Filling mixed whole and broken chips into a flexible bag

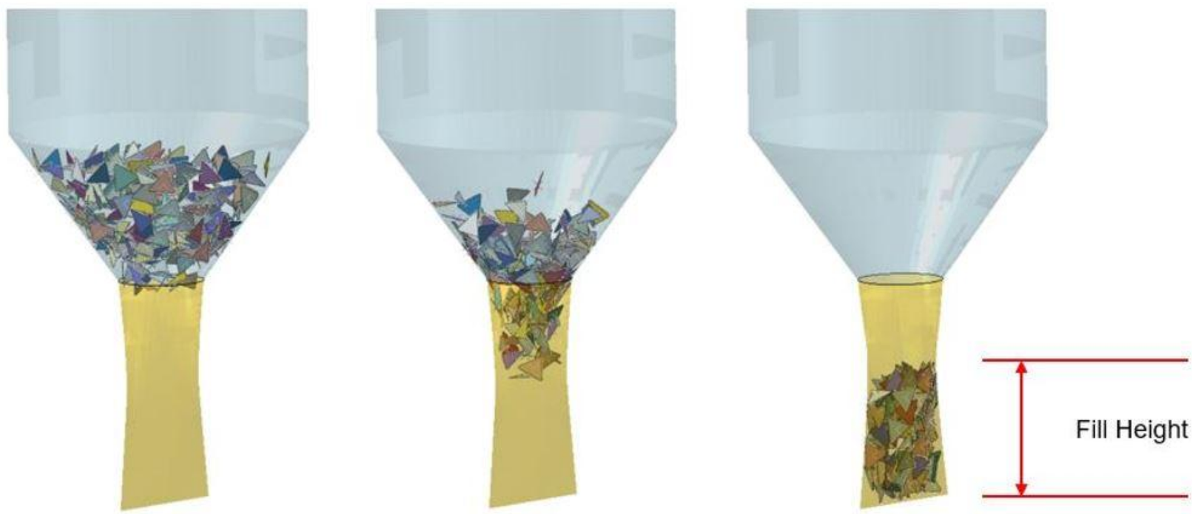

Figure 1: Falling (mixed whole & broken) chips in funnel (Case 3)

Figure 1: Falling (mixed whole & broken) chips transition from funnel to bag (Case 3)

Figure 1: Mixed whole & broken chips settled down in bag (Case 3)

The filling process was simulated 100 times with different and randomized initial chip falling positions and orientations to capture the statistical variations of the chip settling height in the bag.

Findings summary:

Case	Average	Maximum	Minimum	Standard Deviation
1	4.25	4.84	3.81	0.23
2	9.20	9.72	8.72	0.22
3	9.14	9.88	8.62	0.22

The results of the simulations of the three cases show that the average fill height is reduced with broken chips. The simulation technology is commercially viable and to be scaled up in handling the actual bag filling process with more complex shapes of chips and more filling repetitions, to cover tail end of the distribution and increase the confidence level, in addition to preventing production shut down during trial and error testing and tooling set up times.

Employing this simulation tool in conjunction with SES's advanced analytic engineering capabilities, contributes to improved production filling processes, reductions in time, costs and materials needed to produce finished goods, and provides opportunities for driving sustainability in packaging processes.

Other Stress Engineering Publications on Packaging:

Flexible Packaging: A Case Study on Retort Sterilization Simulation

Reducing the Cost of High Pressure Processing (HPP) Packaging Development

When Super High Precision Measurements Are Needed

Stress Engineering Services (SES) has a long history using laser sensor systems for many projects, and has recently developed a new laboratory approach using a con-focal laser. This laser system has the ability to measure sub-micron scale distances on any surface, and, in connection with SES's depth of testing and measuring experience, allows our engineers to develop customized testing services to fit your unique needs.

SES Keyence CL-PT010 Con-focal Laser Sensor

The con-focal method measures transparent glass and polymers, curved surfaces, rough surfaces - all of which can be difficult or impossible to measure with traditional laser displacement sensors. The system is highly insensitive to shock, vibration, and environmental conditions, allowing the sensor head to be mounted on moving components or in industrial environments. Coupled with a stage, the system acts as a sub-micron scale profilometer. The laser can also directly measure the thickness of the component layers in multi-layer transparent or translucent films, with little to no sample preparation providing our engineers with more dynamic information and data on a finite level.

Contact the testing experts at Stress Engineering Services today to discuss how this con-focal laser displacement system can help solve your toughest measurement challenges!

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Stress Engineering Services Blog

Stress Engineering Services, Inc. (SES) offers an integrated team of experts in creative design, functional engineering, design for manufacturing, materials, cost analysis, and reliability to deliver the highest level of innovation and technical success in developing products and packaging. SES provides expert engineering consulting services for:

- New Product Development
- Material Science
- Risk Assessment
- Human Factors
- Failure Analysis
- Package Development
- Testing
- Industrial Design

SES has extensive laboratory testing capabilities for evaluating materials, product performance, life assessment, and failure analysis. We have extensive simulation capabilities to predict mechanical, thermal, and fluid flow characteristics of complex problems.

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Stress Engineering Services, Inc., 7030 Stress Engineering Way, Mason, OH 45040