-- REGISTRATION FORM --

Return the form below by October 1, 2026 with a payment of 1,895* by check or $1,965 by credit card ($2,095* by check or $2,165 by credit card for registrations received October 2, 2026 or later) to:

ETS Inc. - Attn.: Accounting
P.O. Box 7747
Bloomfield Hills MI 48302-7747

*Three or more participants from the same company attending and paying for same seminar are entitled to $200 reduced registration fee per attendee.

♦ Yes, I plan to attend the 3-day course entitled "Automotive Plastic Part Design" to be held October 20, 21 & 22, 2026

Lunch is included for each day of the 3-day seminar.

Please Type or Print

Name: _____

Title: _____

Company: _____

Company Mailing Address: _____

_____

City: _____ St:___ Zip: _____

Phone: ( ) _____ Ext.: _____

E-Mail: _____

Total payment enclosed: _____

Please circle your choice below:

Check enclosed (payable to ETS, Inc.)

Completed original Purchase Order enclosed

Mastercard, Visa

Credit Card No.: _____

Cardholder Name: _____

Expiration Date: _____

Payment in full to be received prior to the seminar start date.

If you must cancel, call ETS at (248) 539-0473. You may cancel your registration for a full refund up to 21 days prior to the seminar. Cancellations received after October 1, 2026, are subject to a $200 service charge. Registrants who fail to attend or who cancel after October 8, 2026 are liable for the entire fee. You may enroll a substitute at any time before the course starts.

For late registrations, cancellations or other questions please call our seminar hot-line: (248) 539-0473.

Walk-in registrants, with payment, will be admitted on an availability basis.

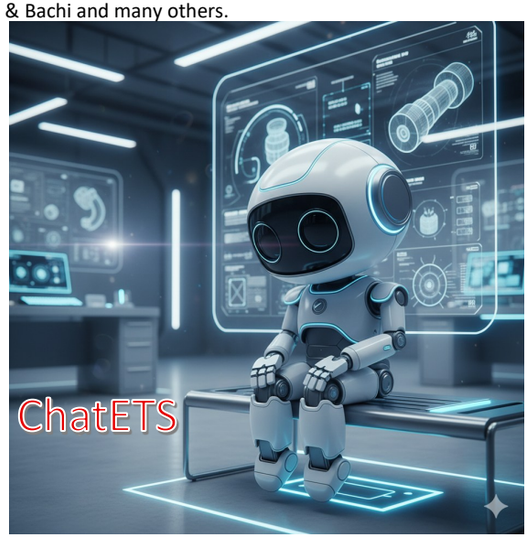
INSTRUCTOR

Paul A. Tres is a Senior Technical Consultant with ETS, Inc. of Bloomfield Hills, Michigan (www.ets-corp.com) serving the plastics and automotive industries. Author of a variety of seminar manuals, technical and marketing papers, including the best selling textbook ***Designing Plastic Parts for Assembly,*** 10th edition, published by Carl Hanser Verlag of Münich, Germany (2024) and computer software for automotive plastic part design.

Speaker, educator, and lecturer at numerous national and international plastics seminars and conferences, with over 20,000 attendees worldwide, for: American Plastics Council, ASME, SAE, SME, SPE, Grand Valley State University, Michigan State University, Polymers Center of Excellence, Purdue University, University of North Carolina, University of Wisconsin - Milwaukee and Madison, etc.

Paul Tres is a Fellow of International Society of Plastics Engineers. He is also an active contributor and member in Plastics Academy, International Society of Automotive Engineers and American Society of Mechanical Engineers.

Mr. Tres is also a highly sought-after expert witness having assisted such law firms as: Griffin & Szipl P.C.; Kreis, Enderle, Callander & Hudgins, P.C.; Lynn, Jackson, Shultz & Lebrun, P.C.; Morgan, Lewis & Bockius, LLP; Sellars, Marion & Bachi and many others.



Course Location

Grand Valley State University
City Campus—DeVos Center, Room 302
401 West Fulton Street
Grand Rapids MI 49504
https://map.gvsu.edu/?id=2127#!ct/76230,79901,80673,76233,77572,78057,78069,78155,78370,78372,79800,79805,80460,80524,80525,80729,81500,88104?s/
http://www.ets-corp.com

Mail registration and payment to:

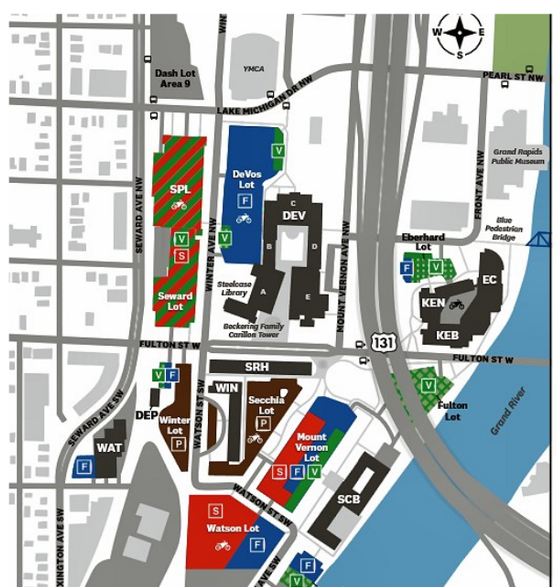
ETS, Inc.
P.O. Box 7747
Bloomfield Hills MI 48302-7747
Phone: (248) 539-0473
Email: info@ets-corp.com

or register on line: www.ets-corp.com

Lodging

Nearby Hotels: ETS does not arrange room accommodations. Hotels located near City Campus - DeVos Center in Grand Rapids, MI are:

+ **Holiday Inn**	0.3 miles
Grand Rapids, MI 49503	P: 616-235-7611
+ **Amway Grand Plaza**	0.5 miles
Grand Rapids, MI 49503	P: 616-774-2000
+ **JD Marriott**	0.5 miles
Grand Rapids MI 49503	P: 616-242-1500



Automotive Plastic Part Design

Embrace the Future of the Industry

Detailed discussion and examples of:

SAFETY SYSTEMS, Powertrain
ChatETS, In-Mold Assembly
Squeaks & Rattles, Integral Seals

Offered by

ETS
www.ets-corp.com

Presented by
Jean-Paul Tres & Paul A. Tres

NOW IN OUR 41st YEAR!

Held at

GRAND VALLEY STATE UNIVERSITY

DeVos Center—City Campus
401 West Fulton Street
Grand Rapids, MI 49504

Tuesday, Wednesday & Thursday
October 20, 21 & 22, 2026
8:30 a.m. - 4:30 p.m.

To register online visit:
www.ets-corp.com/automotive.htm

"This is likely the most informative class I've ever taken"
Jeffrey Lubbers, Development Engineer - Mercedes-Benz

"What a value to be with such an expert!"
Michael Blicher, CGM Director - Magna International

"Mr. Tres is very experienced, knowledgeable and an excellent speaker - a rare combination."
Scott Jarman, Sr. Manufacturing Engineer - Tyco Electronics

Course Description

This three-day in-depth automotive seminar provides information on material selection, design procedure, processing techniques, and assembly methods required for designing with plastics in the automotive industry.

Attendees will focus on what to expect from a polymeric material and discuss methods and methodologies used to simplify the design process and fully comply with FMVSS.

In addition, this course will enable the automotive OEM and the supplier to communicate more effectively. The OEMs will learn how to apply these concepts to their work, thus allowing for cost-efficiencies and fewer second thoughts when they understand the scientific basis, and the fine tuning that comes with experience.

A large number of automotive case histories will explain the step-bystep procedures to successful and robust designs.

Who Should Attend

This course is targeted at designers, product managers, project managers, research engineers, materials engineers, sales and product development engineers and managers, undergraduate and graduate students or anyone involved in the development and manufacture of plastic products.

Its content is intended for a variety of industries such as medical, aerospace, furniture, packaging, computers, electronics, construction, automotive, recycling, consumer products, agricultural machinery, toy industry, fast food industry, and other industries which use plastic components in their products.

A number of case histories, including 26 short movies, will show you step-by-step procedures to successful and robust designs. Plan to come prepared with questions to ask or experiences to share.

Benefits of Attending

* Understand advanced concepts for automotive design
* Learn how to define and use safety factors
* Determine the optimum methodology
* Utilize commercially available software
* Learn how to select materials
* Predict the behavior of plastic materials

Individual Consulting Services

Seminars attendees can sign up for individual consulting sessions with the instructor. The sessions are free and allow the attendee to ask questions and discuss details that cannot be handled in a larger group. Consulting sessions are 20 minutes long and are handled on a first-come-first-served basis. You can sign up for a consulting session after you register for the seminar or during the seminar by contacting us at (248) 539-0473.

Course Program - Day 1

PLASTICS MATERIALS AND AUTOMOTIVE TECHNOLOGIES

North American Automotive Plastics Usage by Segment
Interiors: Infotaiment, Instrument Panel
Exterior: Mega Front End Module & Tesla + Stellantis Wheel Covers
Underhood: Upper Engine Module, Brake-by-Wire,
Steer-by-Wire, Active Suspension
Powertrain/Chassis: Hybrid, Fuel Cells, Electric Vehicles, Composite Brakes

UNDERSTANDING AND SELECTING PLASTIC MATERIALS

Resins: Thermoplastics & Thermosets; Water Assist Injection Molding
Automotive Case History: Kautex/Chrysler Fuel Tank
Mucell, Structures: Crystalline, Amorphous & LCP
Inherently Conductive Polymers (ICP), Plastic Magnet, BioSteel
BioPolymers, Light Emitting Polymers, Nanotubes
Reinforcements: Glass, Aramid, & Carbon + Carbon Nanotubes
Fillers: Talc, Mica, Calcium Carbonate, Wallostonite, Glass spheres
Additives, Effect of Additives, Physical Properties, Elasticity, Toughness, Plasticity,
Notch Sensitivities, Moisture Sensitivity, Shrinkage, Creep, Stress Relaxation,
Automotive Thermal & Chemical Characteristics, Starter Case History

MATERIAL INITIAL SELECTION & SCREENING

Thermal Behavior, Automotive Chemicals
Automotive Case History: Honda Lumbar Support Mechanism
Impact, Specific Gravity & Cost, Engineering Properties
Snap Fits & Hiving Hinges, Assembly Methods

UNDERSTANDING SAFETY FACTORS

What is a Safety Factor?
Using Safety Factors in Automotive Design
Design Safety Factors: Static, Dynamic, Time Related
Material Properties Safety Factors: ISO 9000, Continuous Improvement
Processing Safety Factors, Operating Condition Safety Factors
Reliable Automotive Brands, Legal Aspects of Automotive Business

PROPER AUTOMOTIVE PLASTIC PART DESIGN

Boss Design for Different Type of Polymers
Case History: 1952 De Havilland Comet
Boss Design Layout, Ribbing: Dimensions, Junctions
Automotive Case History: BMW 550i & 750i Transmission Mount
Wall Thickness, Fillets, Part Stiffness, Undercuts
Draft Angles: Core Vs. Cavity, Texturing

STRENGTH OF MATERIALS FOR PLASTICS

Stresses: Tensile, Compressive, Shear, Torsion, Elongations (Strains)
True Stress and Strain Vs. Engineering Stress and Strain
Poisson's Ratio, Elastic Modulus
Young's Modulus, Secant Modulus, Tangent Modulus
Which Modulus to Use, and How to Use It

NON-LINEAR CONSIDERATIONS

Material: Linear and Non-Linear Polymer Models
Geometry: Linear and Non-Linear Models
Finite Element Analysis (FEA) and How to Use It
Non-Linear Considerations, Behavior Modeling (BMX),
Sight - Design of Experiments, DFMPro Assistance Module
TRIZ: Theory of Solving Problems Inventively

ULTRASONIC WELDING

Equipment, Vibration Types, Ultrasonic Cycle
Design: Shear Joint & Energy Director Joint
Heat Stake Joint Design: Flash, Hollow, Spherical
Spot Welding, Swaging, Stud, Heat Staking
Post Design: Round Solid, Round Hollow, Cross

HOT PLATE WELDING

Equipment , Process
Joint Area Strength Capability, Joint Design
Automotive Case History: Mercedes-Benz Windshield Washer Bottle

Course Program - Day 2

VIBRATION WELDING

Equipment, Process
Phases, Cross-thickness
Joint Design, Welding Glass Reinforced Polymer, Fixture Design
Automotive Case History: PSA Peugeot Citroën - Diesel Engine AIM & VW Sharan

ELECTROMAGNETIC WELDING

Equipment
Induction Coil Materials
Bonding Agent
Joint Design
Automotive Case History: Mitsubishi Motors - Power Steering Fluid Reservoir

LASER WELDING

Surface Heating & Through Transmission
Joint Designs, Examples
Automotive Case History: Mercedes-Benz Ignition Key

HOT GAS WELDING: Equipment, Joint Design

BONDING

Failure Theories: Adhesive, Cohesive
Substrate Wettability Tests, Drafting Symbols
What is Surface Energy and How to Improve It
Surface Treatments: Corona, Plasma, Flame
Bonding Stresses: Tensile, Shear, Peel, Cleavage, Compression
Joint Designs
Automotive Case History: Chrysler CCV Car Program
Stress Cracking, Adhesives, Solvents

AUTOMOTIVE PAINTING

Adhesive Promoters, Primers, Base Coat, Top Coat
Painting Considerations, Painting Work Flow
Power Wash Parameters
Automotive Case History: Mercedes-Benz Wheel Hub Cover

PRESS-FITS

Material Properties, Geometric Definitions, Safety Factors, Creep, Loads
Press-Fit Theory
Design Algorithm Methodology
Case History: Cassette Deck
Automotive Case History: Chrysler Upper Intake Manifold
Fusible Core Injection Molding
Upper Intake Manifold Design Requirements
CAMPUS (Computer Aided Material Preselection by Uniform Standards)
Design Algorithm
Case History: Successful Press-Fit Designs

LIVING HINGES

Design for Polyolefins
Common Living Hinge Design
Design for Engineering Plastics
Design Analysis
Elastic, Elastic/Plastic, Plastic Hinge Designs
Automotive Case History: Delphi World-Class Connector
Step-by-Step Design Analysis
Automotive Case History: GM V-6 Ignition Cable Bracket
Molding Hinges, Processing Issues
Coined Hinges
Class Exercise #1: Design, Material Selection & Tooling
Oil-Can Terminology & Concepts, Oil-Can Designs
Software Demo for Designing Living Hinges

TOOLING CONSIDERATIONS

Gate Design: Direct, Edge, Film, Fan, Tunnel, Pin
Sprue, Spoke, Disk, Diaphragm, Valve, Hot Runner
Reverse, Z, & Ring Sprue Puller, Design Formula
Runner Design: Runner Cross-Section

Course Program - Day 3

SNAP FITS

Material & Design Considerations
Assembly Positioning, Assembly Motions, Yield Criteria
Safety Factors & Cantilever Snap-Fits
Snap-Fits: Angle of Deflection, Self-Locking Angle
Automotive Case History: Tesla Door Panel
One-Way Continuous Beam with Rectangular Cross Section
Finite Element Analysis Example
Case History: Hewlett-Packard Omnibook Laptop
Class Exercise #2: Cantilever Beam Calculation
Annular Snap-Fits: Shallow Groove, Deep Groove
Case History: Pen & Cap
Torsional Snap-Fits
Automotive Case History: GM World Class Connector
Case History: Snap-fits Which Kill — FirstSave Defibrillator
Deformable Rib Design, Springiness Rate, Automotive Recyclability
Symbols for Plastics - Class Exercise - Cantilever SNAP-FIT
Assembly-Disassembly Assists, Preventing over-deflection
Automotive Case History: Honda Accord Lumbar Support Actuator
Tooling for Snap-Fits, Issues with Snap Fitting
Case History: Injection Blow Molded Bottle Assembly

ChatETS — From Design To Part AI-Powered Engineering Excellence

AUTOMOTIVE INTEGRAL SEAL DESIGN

Design Issues: Integral Seal - Design A & Design B
Structural Analysis: Step 1 through 7, Material Model
Engineering Stress-Strain Curve
True Stress-Strain Curve - Plastic Region
Analysis Results: Total Displacement, Von Mises Stresses
Simulating Leak Through Seal 1 & Through Seal 2
Processing Issues, Drying, Melt Temperature
Injection Rate, Screw Forward Time, Mold Temperature
Tool Design: Mold Closed - Part Filling

OVER-MOLDING AND IN-MOLD ASSEMBLY

Reasons for Multi-Material, Materials Compatibility, Pulsafe FitLogic
Part Design & Material Selection, Materials Incompatibility For IMA
Indexing (Rotating Platen) Tool, Mold with Core Retraction
Automotive Case History: TRW/ZF Louver Assembly

TROUBLESHOOTING

Air Traps, Black Specks, Burn Marks, Dark Stripes
Flashing, Flow Marks, Hesitation, Jetting
Peeling, Sink Marks, Shrinkage, Splay, Sprue Sticking, Unfilled Parts
(Short Shots), Unmelt, Warpage, Waves, Weld lines
Class Exercise #3: Rim

FASTENERS

Self-Threading, Tread Forming, Recessed Driving Heads
Clamp Load Vs. Time
Torque Vs. Penetration Depth
Type AB, Type B, Type C, Hi-Lo, PT,
Free Body Diagram, Pullout Load Vs. Engagement Area
Assembly Stress, Plastic Boss Design for PT Fasteners
RS Plast, Delta PT , Polyfast, and Plastite Thread Designs
Automotive Case History: Threaded Assembly Calculation
Weld and Meld Lines
Thread Cutting: BF, T, Hi-Lo, RS Duroplast, & Duro PT
Pilot Hole Design Detail

PLASTIC PART DESIGN ON THE WORLD WIDE WEB
PROJECTS REVIEW SESSION -- FREE

Seminar Schedule
October 20, 21 & 22, 2026

8:00 a.m. - 8:30 a.m. Registration (Day 1 only)
8:30 a.m. - 4:30 p.m. Course Hours