CathCAD® Deflection Modeling

The Software for Designing your Next MicroCatheter

Ron Roth, Ph.D.

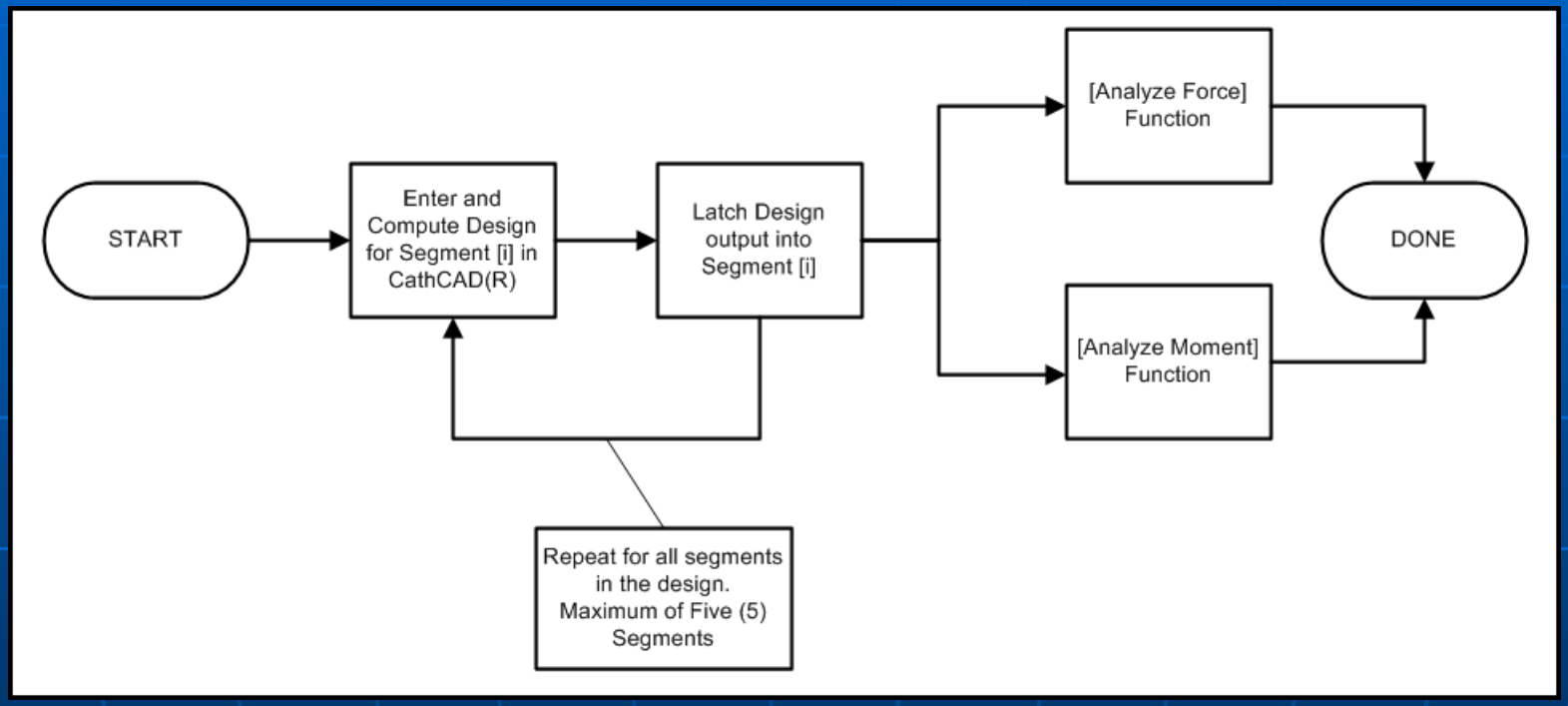
Roth Technologies, LLC

sales@cathcad.com

Background Information

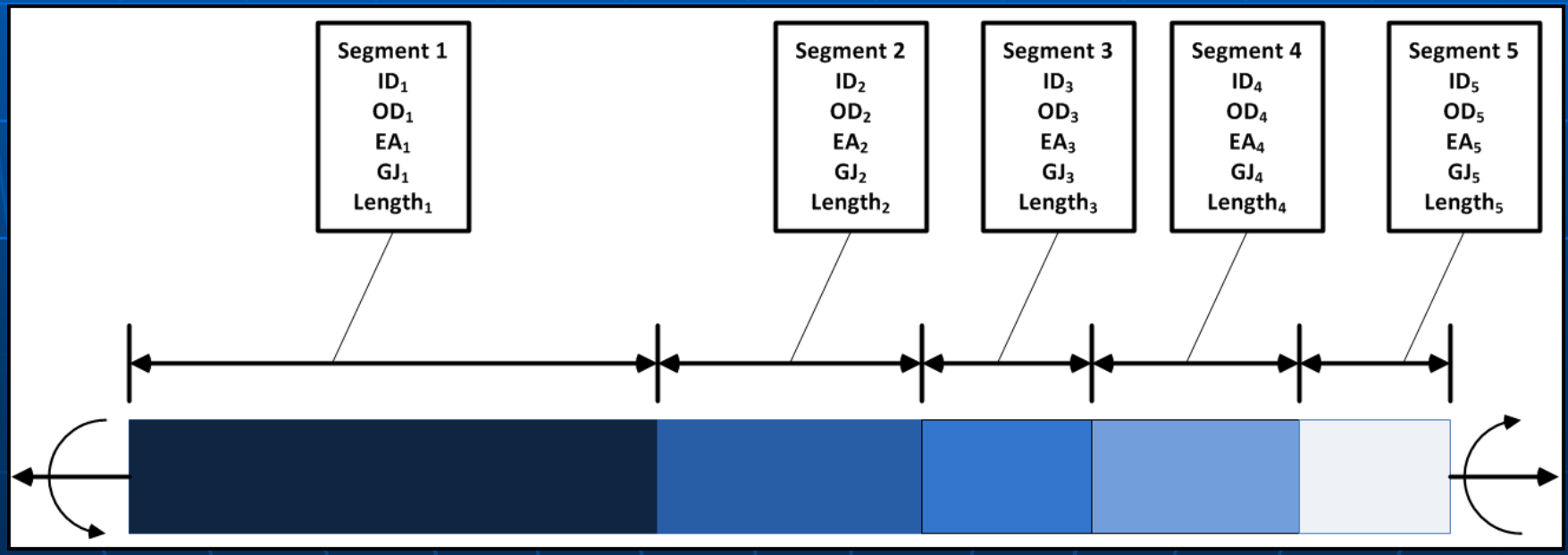
- CathCAD® Standard V3.1 and Advanced V4.7 introduce the capability of computing elongation and angular rotation when subjected to a Force/Moment
- Multi-segmented designs are supported with one to five segments
- Resulting Design may be placed under a Longitudinal Force and/or Moment about the Longitudinal Axis of composite tube
- Outputs
  - Applied Force Module: Total elongation, elongation of each segment, and strain
  - Applied Moment Module: Total angular twist, angular twist of each segment, and shear strain

Process Flow



Multi-Segment Model Illustration

- Support for one to five segments
- Model support for Force applied along the longitudinal axis
- Model support for Moment/Torque applied about the longitudinal axis



Inputs to the Force/Torque Modules

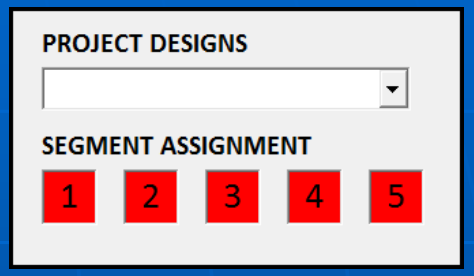
- Inputs to the Elongation Model
  - ID and OD
  - $EA_{composite}$: Computed by CathCAD® Software
  - Segment Length
  - Force
- Inputs to the Angular Twist Model
  - ID and OD
  - $GJ_{composite}$: Computed by CathCAD® Software
  - Segment Length
  - Applied Moment/Torque

Loading/Latching Design into Module

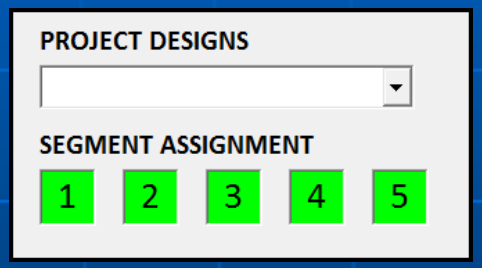
- The Composite Tube Design parameters may be latched/loaded into the module directly after computing the output parameters within the Software via the [COMPUTE] button
  - A Segment has not been loaded if it has a RED background
  - A Segment has been loaded if it has a GREEN background
  - Segments may be latched/loaded in any order
- User may simply click on the [1], [2], [3], [4], and/or [5] to latch a design
  - A minimum of [1] segment must be defined
  - A maximum of [5] segments may be defined

Software Interface

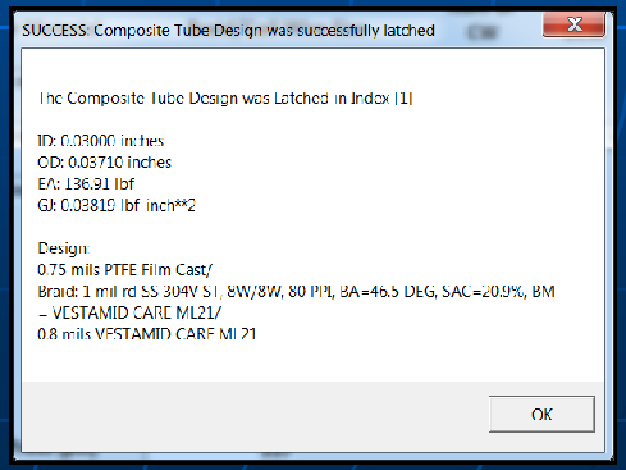
- Screenshot of no segments latched



- Screenshot of all segments latched



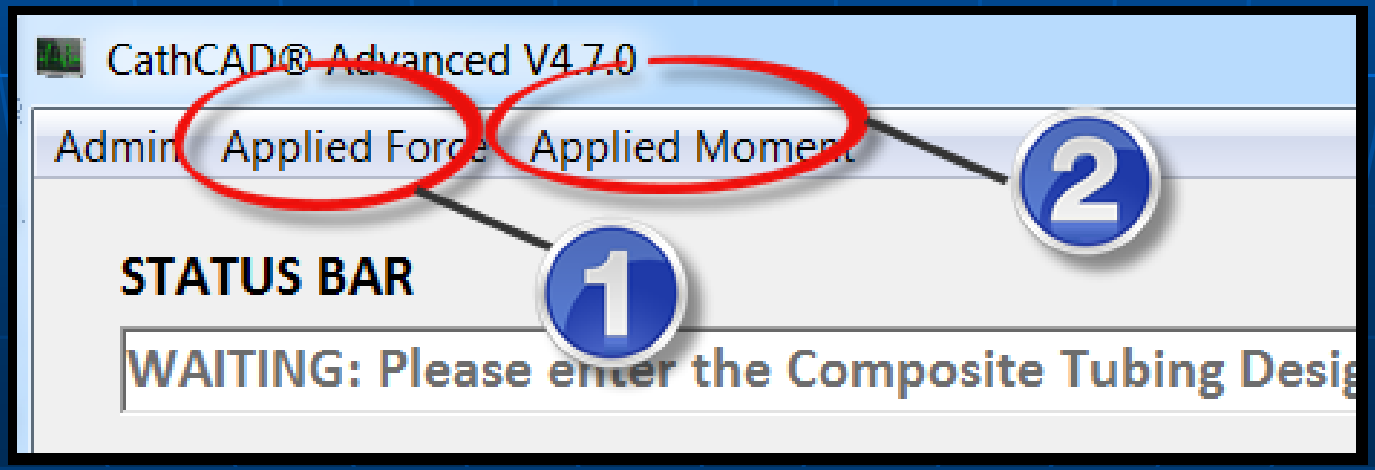
- Software confirmation



Applied Force/Applied Moment

Once the applicable designs are “latched” into the applicable segments the Analysis Tools become available to the User from the Menu

- (1) = Applied Longitudinal Force
- (2) = Applied Moment about the Longitudinal Axis



Applied Force User Interface

CathCAD® Deflection Model

RETURN

STATUS BAR

WAITING: Please enter an updated applied force (lbf) and/or individual segment lengths as applicable

Applied Force (lbf) 0.0900 Longitudinal Force that is applied to the composite tube

Total Deflection (inches) 0.069750

Seg #	Enable	ID (inches)	OD (inches)	Segment Design	Length (inches)	EA (lbf)	Stiffness (lbf/inch)	Deflection (inch)	Strain (inch/inch)
1	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = VESTAMID CARE ML21/ 0.8 mils VESTAMID CARE ML21	36.00	136.91	3.803	0.023666	0.000657
2	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 7233 SA01/ 0.8 mils PEBAX 7233 SA01	3.00	55.63	18.544	0.004853	0.001618
3	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 6333 SA01/ 0.8 mils PEBAX 6333 SA01	3.00	34.02	11.341	0.007936	0.002645
4	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 4033 SA01/ 0.8 mils PEBAX 4033 SA01	3.00	13.05	4.349	0.020693	0.006898
5	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 3533 SA01/ 0.8 mils PEBAX 3533 SA01	1.00	7.14	7.142	0.012602	0.012602

Applied Moment User Interface

CathCAD® Applied Torque Model

RETURN

STATUS BAR

WAITING: Please enter an updated applied force (lbf) and/or individual segment lengths as applicable

Applied Torque (lbf-inch) 0.02000 — Applied moment that is applied to the composite tube — Angular Deflection (rad) 27.9739

Seg #	Enable	ID (inches)	OD (inches)	Segment Design	Length (inches)	GJ (lbf-inch^2)	Stiffness (lbf-inch)	Ang Deflect (radians)	Shear Strain (radians)
1	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = VESTAMID CARE ML21/ 0.8 mils VESTAMID CARE ML21	36.00	0.0382	0.0011	18.8512	0.009714
2	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 7233 SA01/ 0.8 mils PEBAX 7233 SA01	3.00	0.0257	0.0086	2.3367	0.014448
3	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 6333 SA01/ 0.8 mils PEBAX 6333 SA01	3.00	0.0225	0.0075	2.6641	0.016473
4	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 4033 SA01/ 0.8 mils PEBAX 4033 SA01	3.00	0.0196	0.0065	3.0597	0.018919
5	☑	0.03000	0.03710	0.75 mils PTFE Film Cast/ Braid: 1 mil rd SS 304V ST, 8W/8W, 80 PPI, BA=46.5 DEG, SAC=20.9%, BM = PEBAX 3533 SA01/ 0.8 mils PEBAX 3533 SA01	1.00	0.0188	0.0188	1.0622	0.019705

Contact Information

sales@cathcad.com
210-380-9890