Hybrid Calculation Settings Adjustment

Geometry in Use

Stochastic Positioning of Cables in Route

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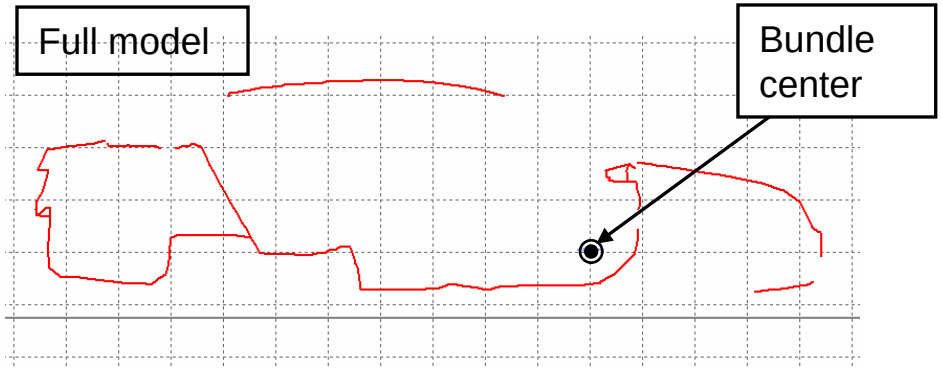
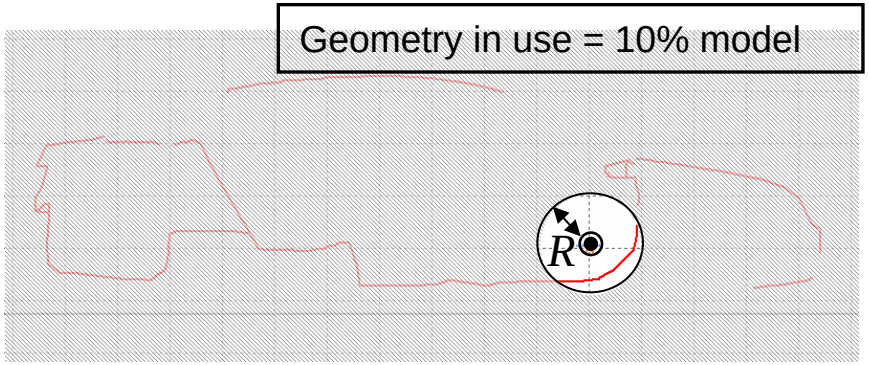
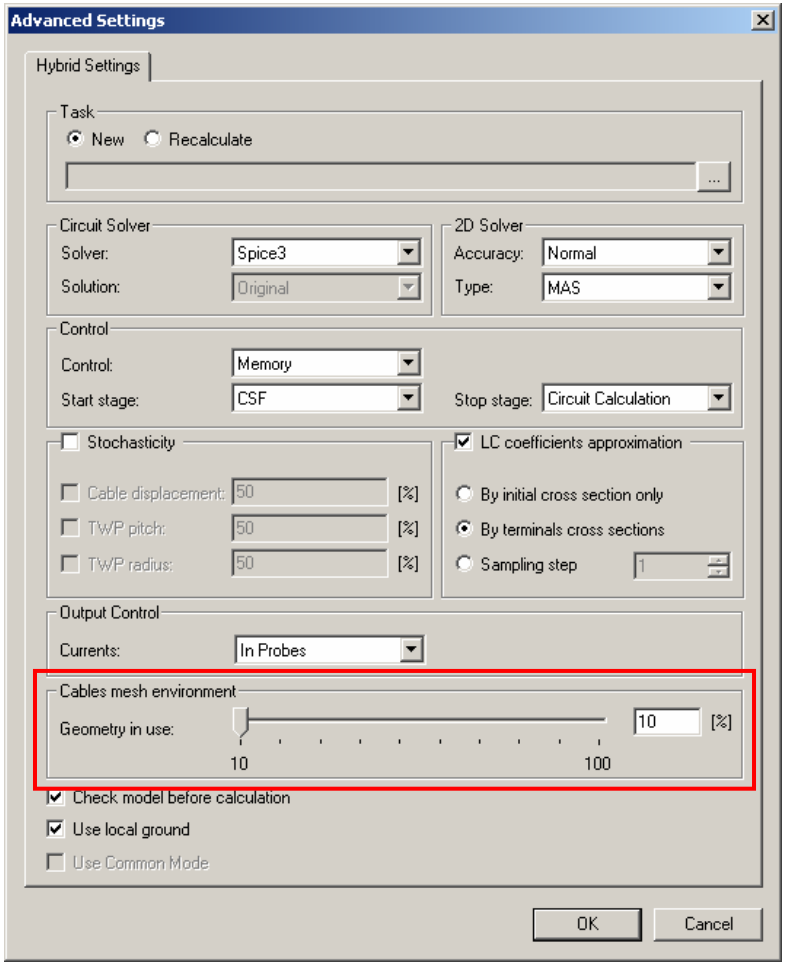
Geometry in Use

Definition of *Geometry in Use* option

Geometry in use command allows to neglect in calculation all geometry objects around cable bundle that are located further than the defined area set in percentage.







Geometry in Use

Definition of *Geometry in Use* option

The defined area is determined as circle around bundle center with radius calculated as shown below:

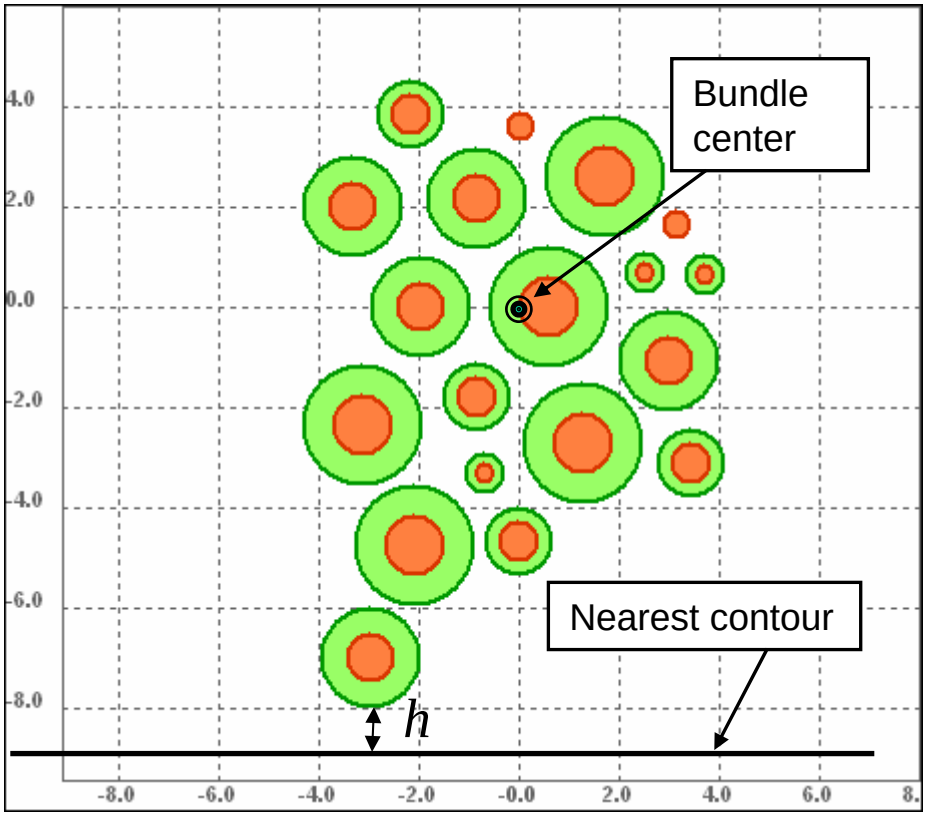
$$R = coef \times h$$

Where h is height from the nearest contour to the nearest cable, and $coef$ is defined by formula:

$$coef = 10 + \frac{GS - 10h}{90h} GIU$$

Where GS is maximum size of geometry, and GIU is **Geometry in use** value in percentage. Other values are special coefficients necessary for calculation

Cable bundle cross-section view

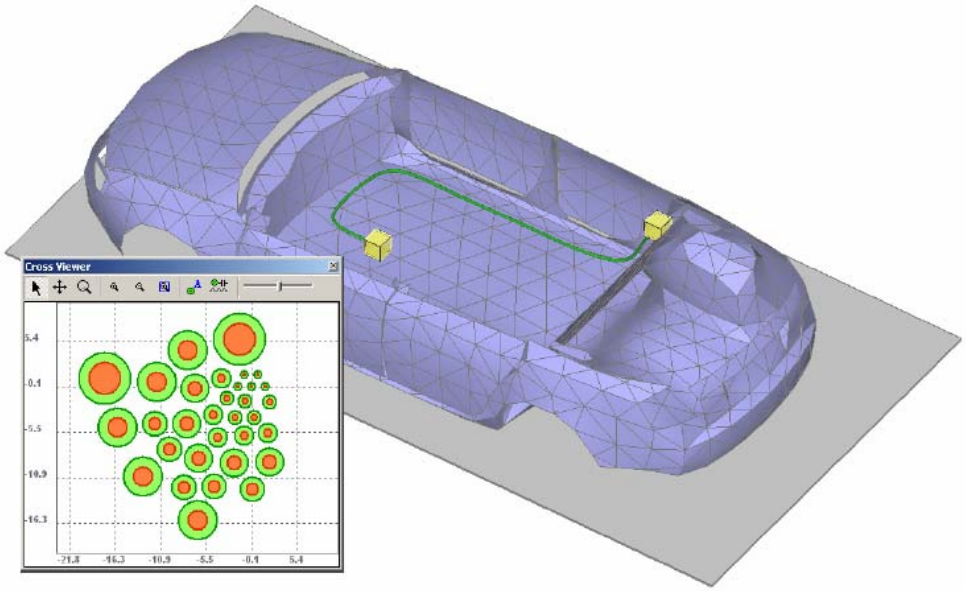


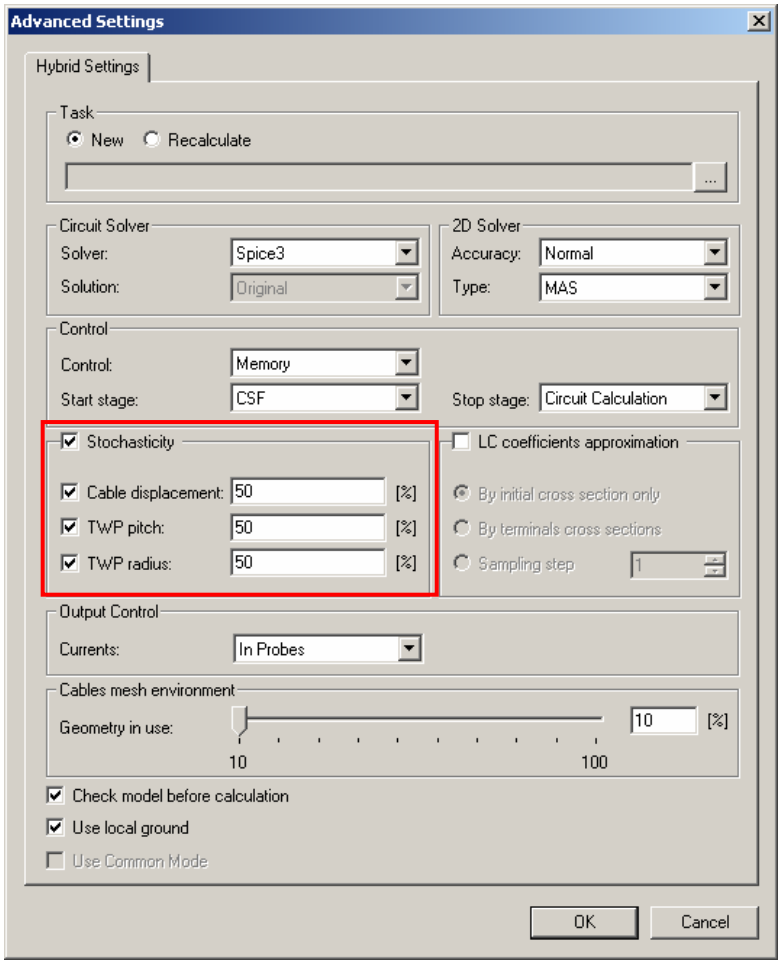
Stochastic Positioning of Cables in Route

Definition of *Stochasticity*

In most cases exact location of cables inside bundle in complex system such as car are unknown.

Stochasticity option allows random rearrangement of cables inside bundle to make it possible to investigate different cases and achieve definite range of values in frequency domain considering all cases





Stochastic Positioning of Cables in Route

Stochasticity options

Several options of the bundle can be varied to achieve different arrangements. These are:

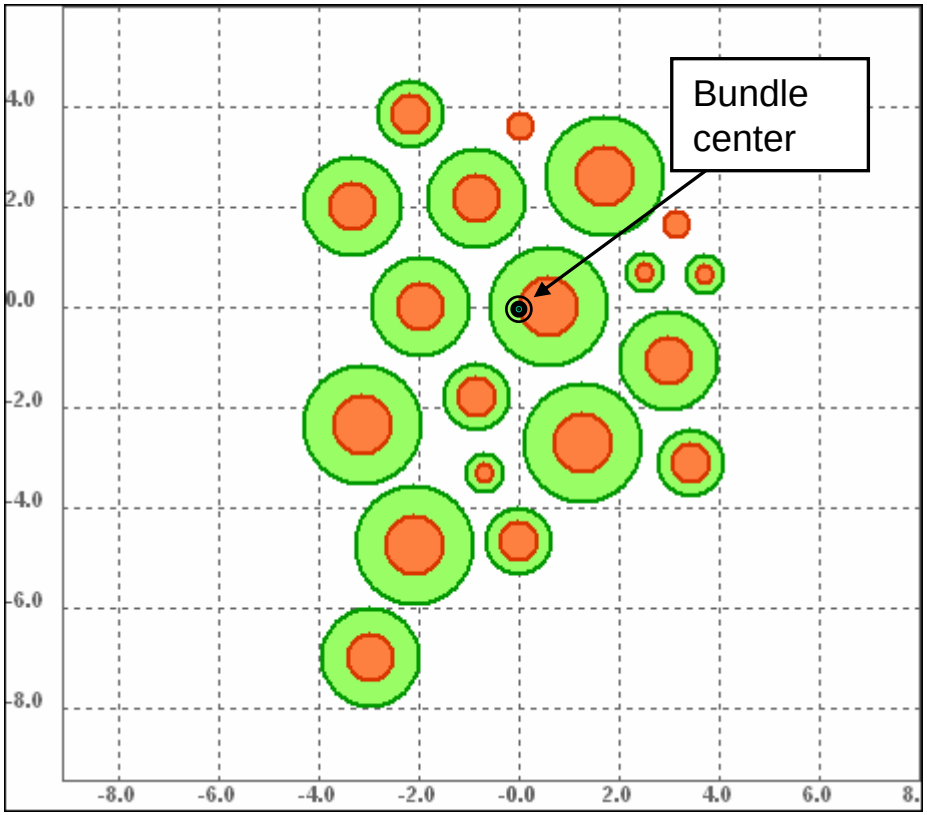
- **Cable displacement**
- **TWP pitch**
- **TWP radius**

According algorithm of cable positioning inside the bundle, they are randomly distributed around the bundle center.

By checking each of the above options one will get different arrangement of cables in different cross-sections which make the simulation much closer to reality

Setting zero or unchecking the ***TWP pitch or TWP radius*** option means that arrangement of TWP will be fixed along the cable; unchecking ***Cable displacement*** means that arrangement will be fixed in all cross-sections

Cable bundle cross-section view



Stochastic Positioning of Cables in Route

Stochasticity options - Cable displacement

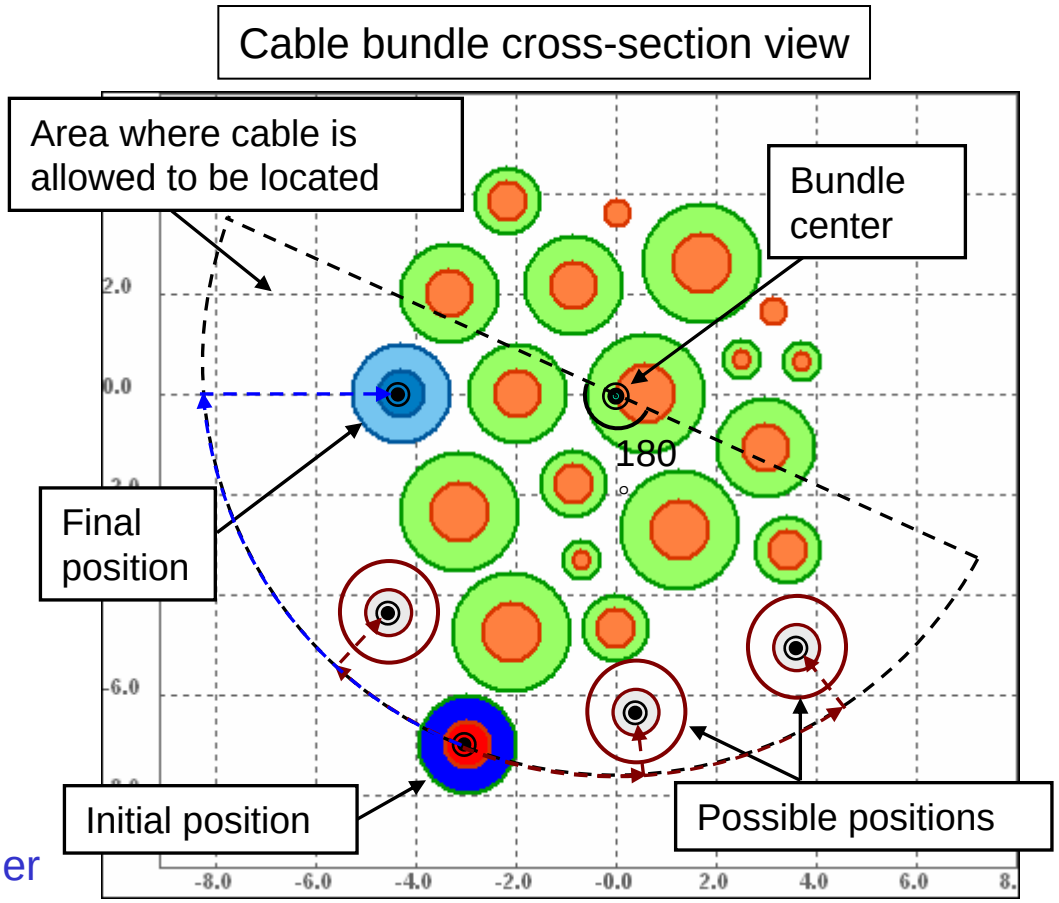
Switching ***Cable displacement*** option, enables cables to seek closest location to the bundle center by first moving along circle around the center and then towards the center.

Limiting stochasticity of the cable displacement means limiting rotation angle around center, along which the cable will move to find the closest location towards it.

When 50% is checked, the cable is allowed to move 180° along circle surrounding bundle center

$$\frac{360° \times 50\%}{100\%} = 180°$$

90° in one direction and 90° in another

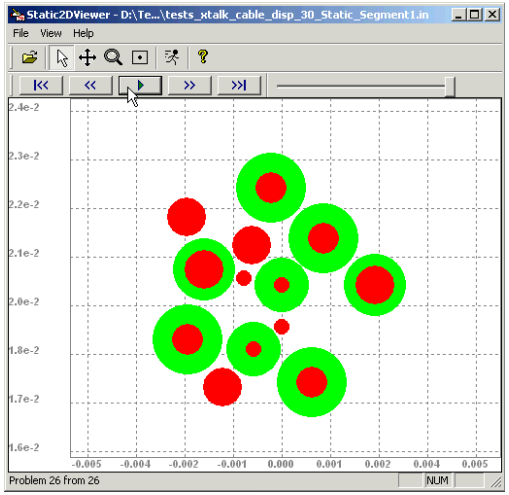


The cable is moving along blue arrow shown above

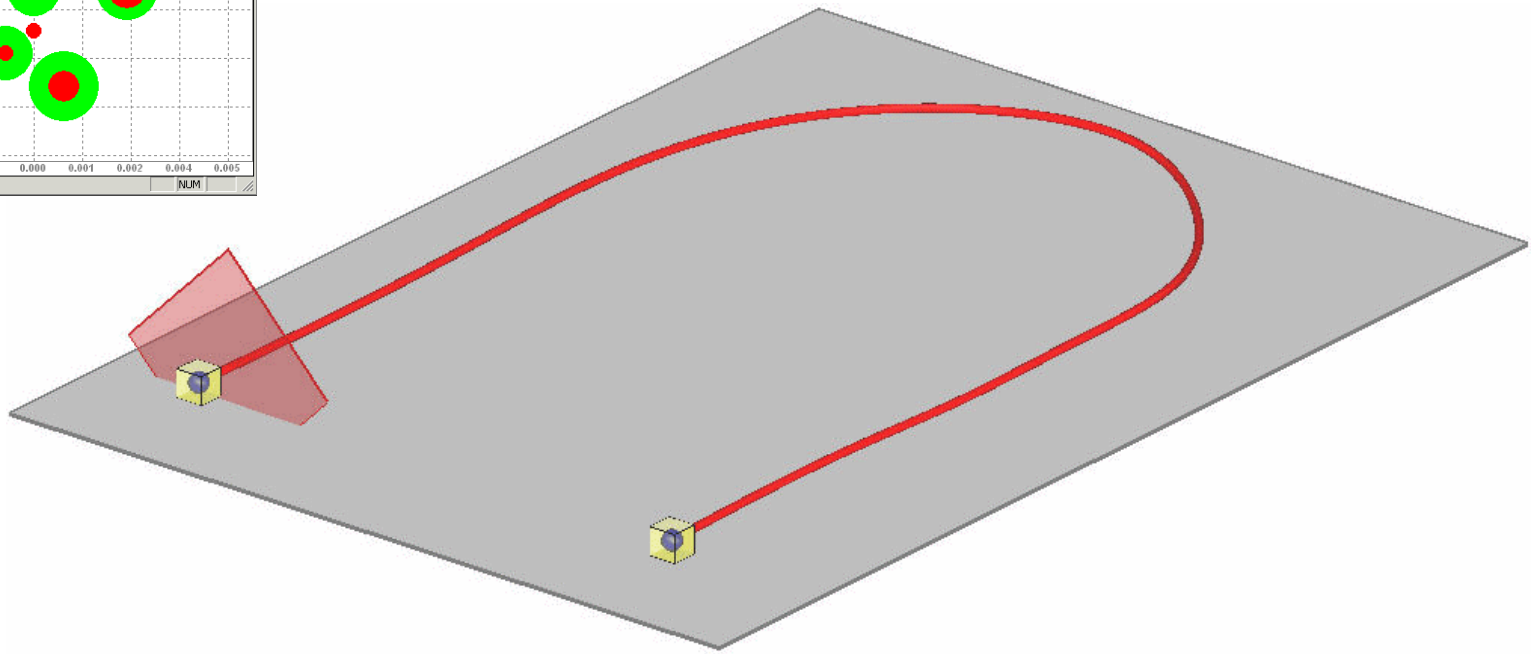
Stochastic Positioning of Cables in Route

Stochasticity options - Cable displacement - example

Cross-section view



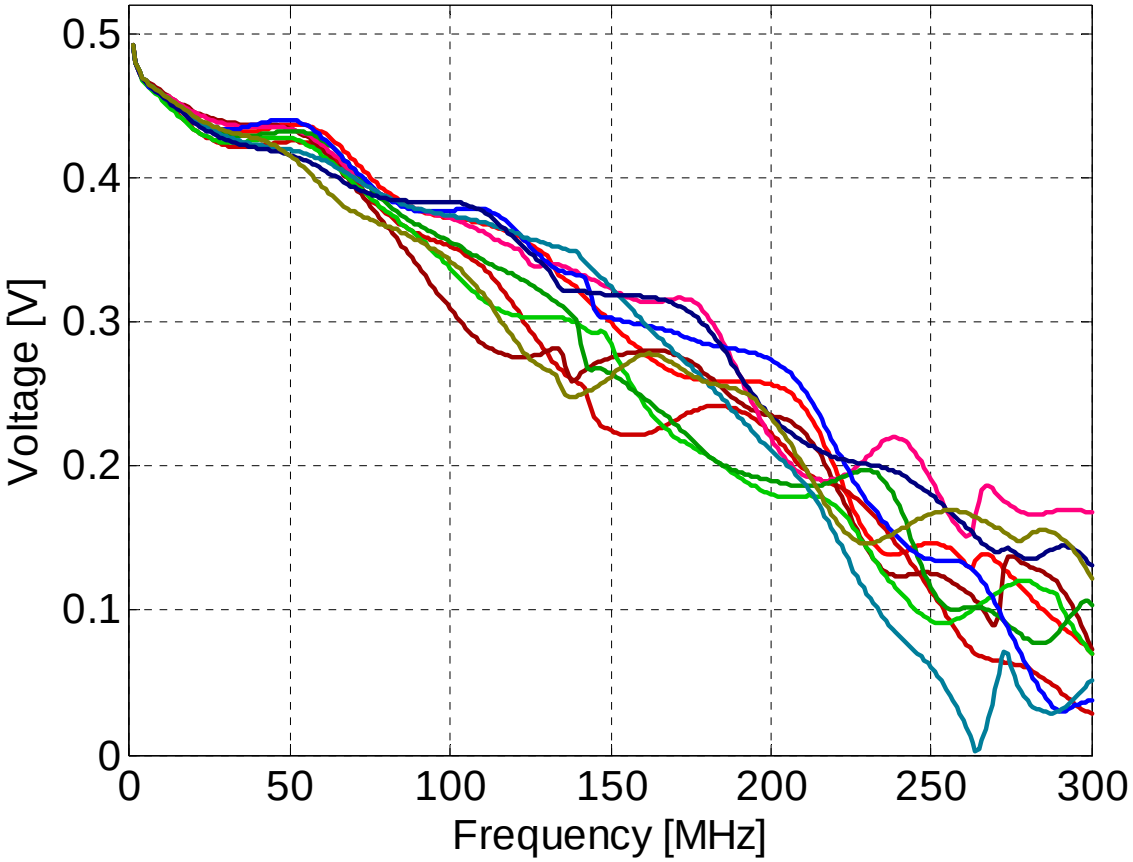
- A bundle of 1 active cable and 12 passive cables
- 1 V source set on active cable termination and 50 Ohm loads on both terminations of each cable
- Calculation frequency range is 1 - 300 MHz
- Cable length is 1.33 m



Stochastic Positioning of Cables in Route

Stochasticity options - Cable displacement - example

Voltage on the active cables passive termination
Stochasticity of cable displacement = **10%**



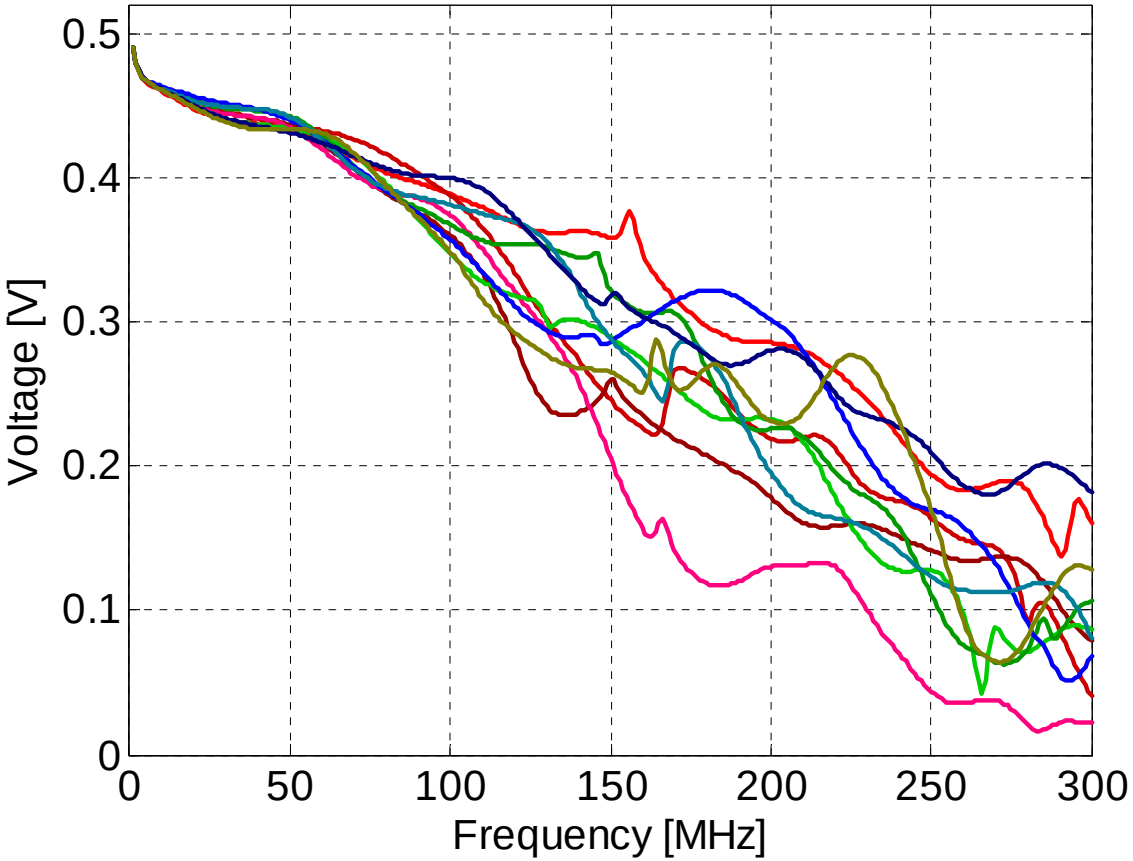
This graph shows voltage calculated on passive termination of an active cable in cable bundle consisting of one active and 12 passive cables in case of 10 tests made using ***Cable displacement*** stochasticity equal to 10%

It is obvious that for fixed stochasticity results can be obtained in some limited range of values. By increasing stochasticity, the range will also increase

Stochastic Positioning of Cables in Route

Stochasticity options - Cable displacement - example

Voltage on the active cables passive termination
Stochasticity of cable displacement = **30%**



This graph shows voltage calculated on passive termination of an active cable in cable bundle consisting of one active and 12 passive cables in case of 10 tests made using ***Cable displacement*** stochasticity equal to 30%

It is obvious that for fixed stochasticity results can be obtained in some limited range of values. By increasing stochasticity, the range will also increase

Stochastic Positioning of Cables in Route

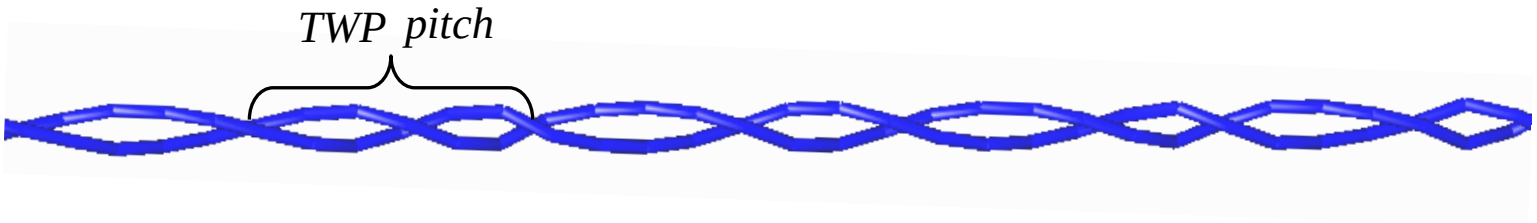
Stochasticity options - TWP pitch

Switching ***TWP pitch*** option, enables control over TWP cables arrangement along the route.

Limiting stochasticity of the pitch means limiting pitch length variation along cable by means of percentage portion of the pitch, i.e. length of the pitch in case of enabled stochasticity will be in the range:

$$L \in \left[L_0 - \frac{L_0 \cdot S}{100}; L_0 + \frac{L_0 \cdot S}{100} \right]$$

Where L_0 is fixed user-defined pitch length and L is length of pitch with enabled stochasticity. S is stochasticity value defined in percentage. Pitch length is updated in each cross-section.



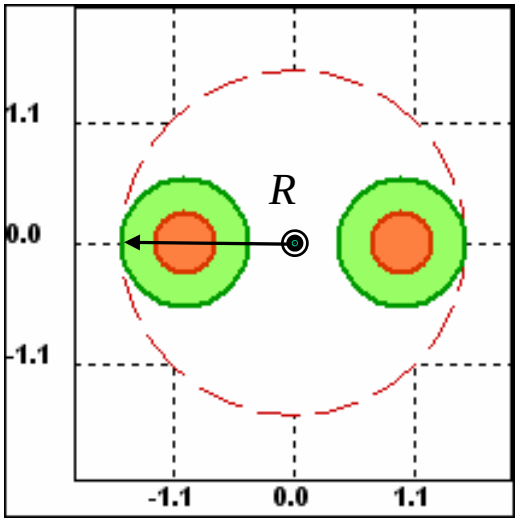
When 50% stochasticity is enabled in case of user-defined pitch length equal to 2 cm, it means that pitch along cable might vary from 1 cm to 3 cm

Stochastic Positioning of Cables in Route

Stochasticity options - TWP radius

Switching ***TWP radius*** option, enables control over TWP cables arrangement in the cross sections.

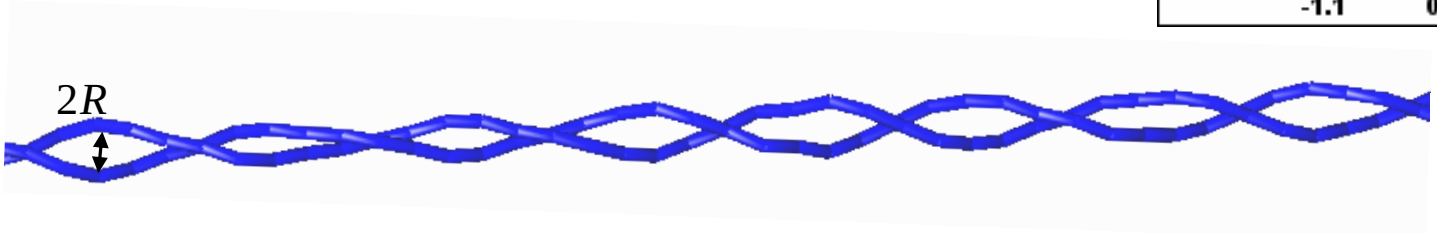
TWP cross-section view



Limiting stochasticity of the twp radius means limiting twp radius length variation in each cross-section by means of percentage portion of the initial radius, i.e. length of the radius in case of enabled stochasticity will be in the range:

$$R \in \left[R_0 - \frac{R_0 \cdot S}{100}; R_0 + \frac{R_0 \cdot S}{100} \right]$$

Where R_0 is fixed user-defined twp radius and R is twp radius in case of enabled stochasticity. S is stochasticity value defined in percentage.



When 80% stochasticity is enabled in case of user-defined twp radius equal to 2 mm, it means that TWP radius along cable might vary from 0.4 mm to 3.6 mm

Thank you for your attention

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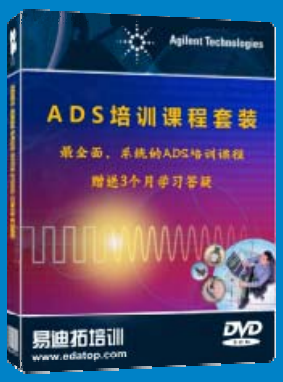

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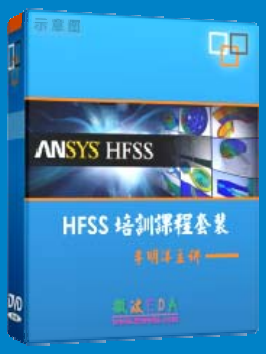

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