

Расстройка силой Лоренца



Постановка задачи

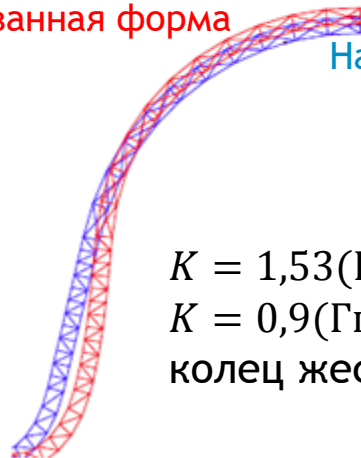
Статический анализ



Создаваемое давление $P = \frac{1}{4} \times (\mu_0 H_s^2 - \epsilon_0 E_s^2)$

Деформированная форма

Начальная форма



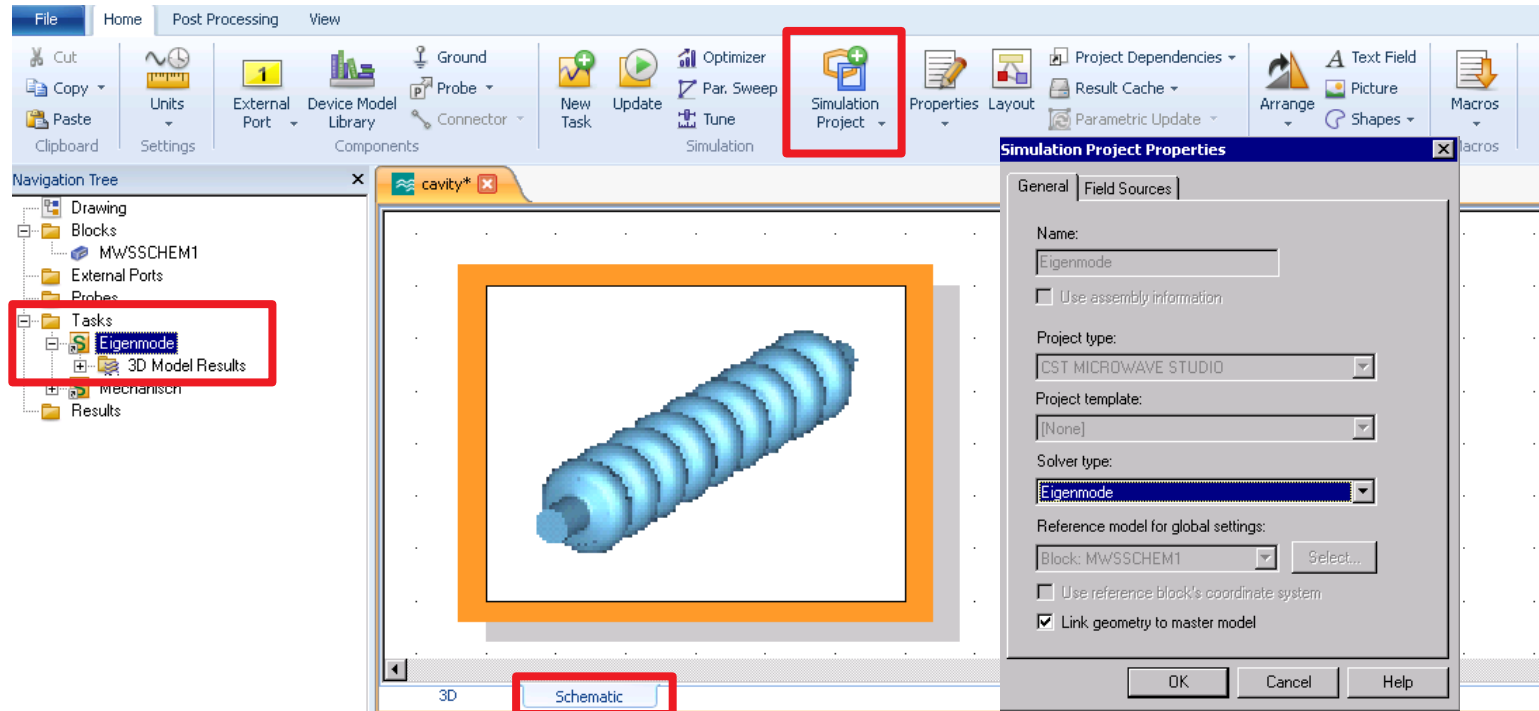
Расстройка силой Лоренца: $\Delta f = -KE_{\text{уск}}^2$

$K = 1,53(\text{Гц}/(\text{МВ}/\text{м})^2)$: 9-ти ячеечный резонатор без колец жесткости.

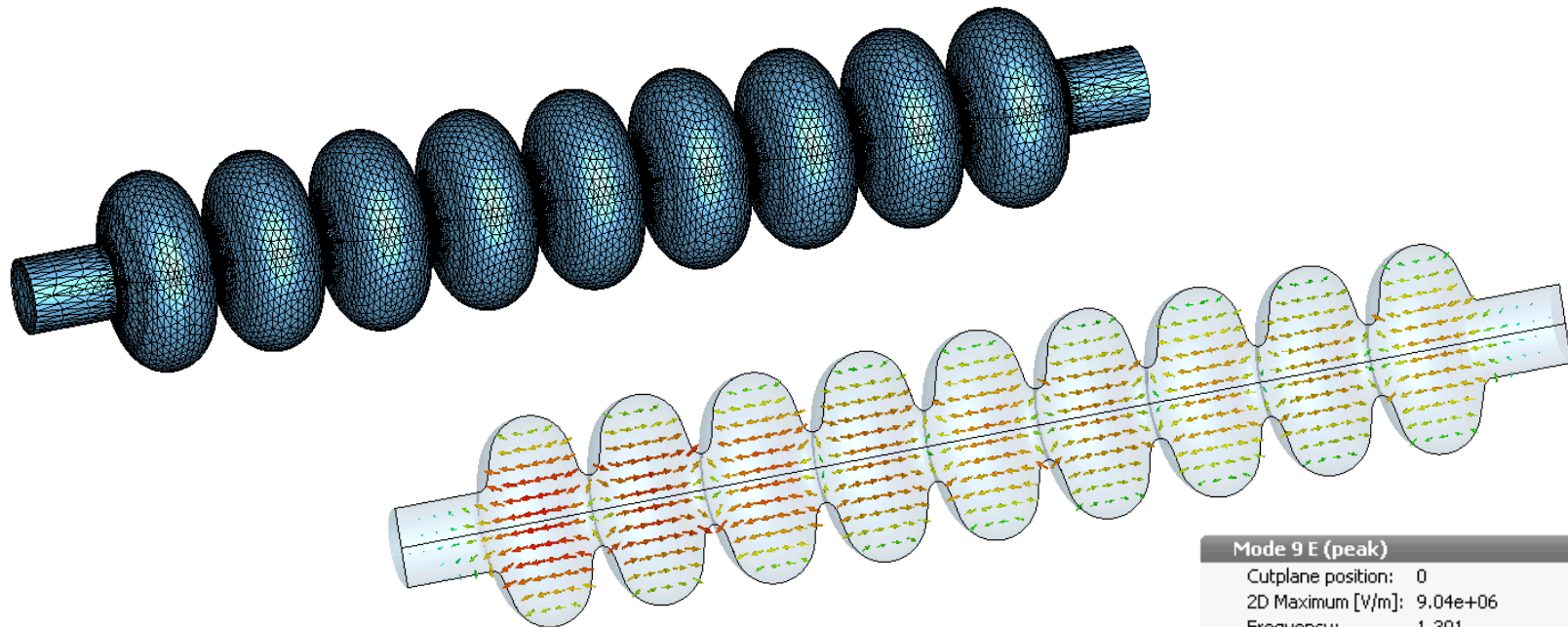
$K = 0,9(\text{Гц}/(\text{МВ}/\text{м})^2)$: 9-ти ячеечный резонатор с использованием колец жесткости

Моделирование составных проектов (SAM)

Создание проекта моделирования для расчета собственных мод



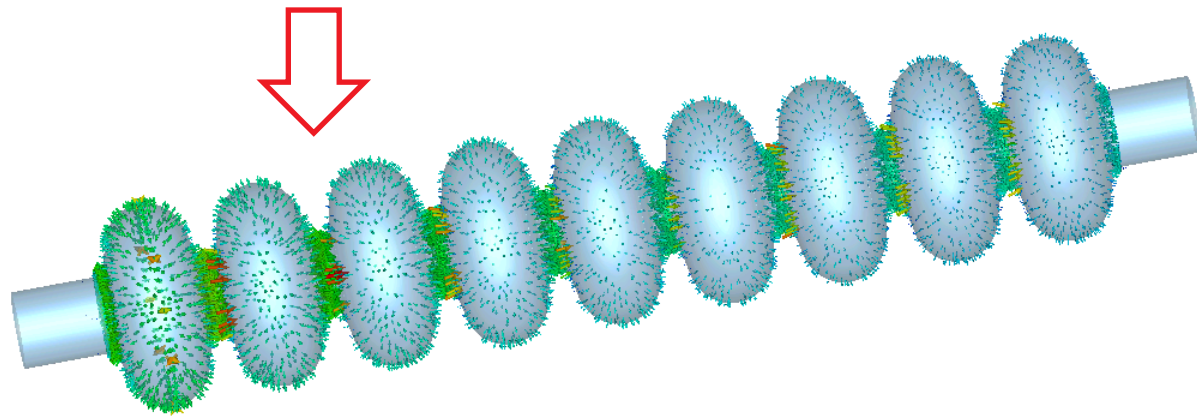
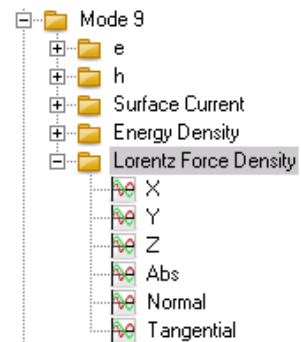
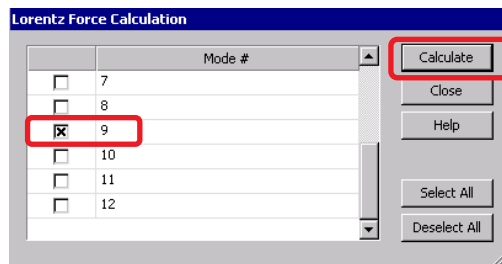
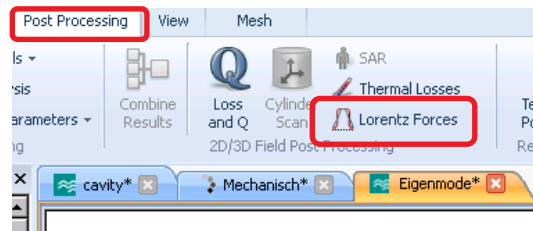
Запуск тетр. E-солвера



Mode 9 E (peak)

Cutplane position: 0
2D Maximum [V/m]: 9.04e+06
Frequency: 1.301
Phase: 0

Расчет плотности силы Лоренца



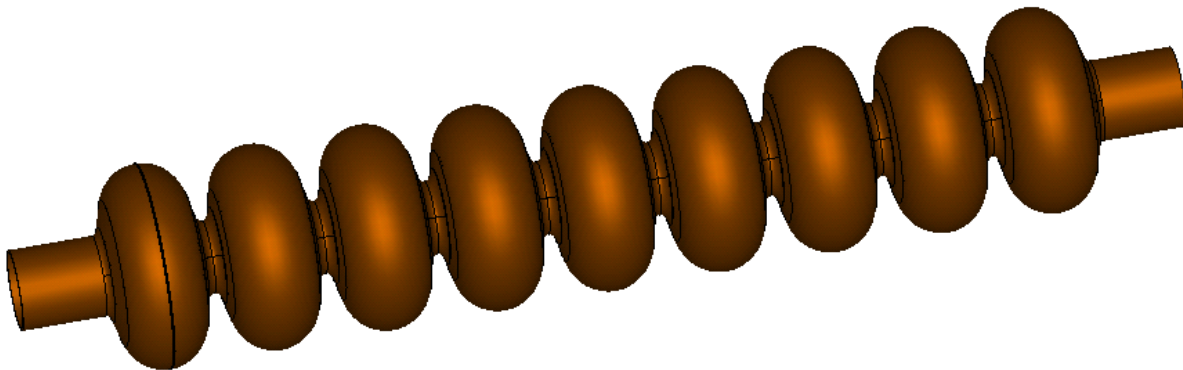
Lorentz Force Density (rms)
3D Maximum [N/m²]: 1164

Проект моделирования для анализа механики

The screenshot displays the CST Studio Suite software interface. The top ribbon includes tabs for File, Home, Post Processing, and View. The Home tab is active, showing various toolbars. A red box highlights the 'Simulation Project' icon in the Simulation group. The Navigation Tree on the left shows a project structure with 'Mechanisch' selected and highlighted by a red box. The main workspace shows a 3D model of a blue cylindrical component with a grid, enclosed in an orange frame. A red box highlights the 'Schematic' view selector at the bottom. The 'Simulation Project Properties' dialog box is open on the right, with the 'General' tab selected. A red box highlights the 'Structural Mechanics' option in the 'Solver type' dropdown menu. Other fields in the dialog include 'Name: Mechanisch', 'Project type: CST MPHYSICS STUDIO', and 'Project template: [None]'. The 'Block' is set to 'MWSSCHEM1' and 'Link geometry to master model' is checked.

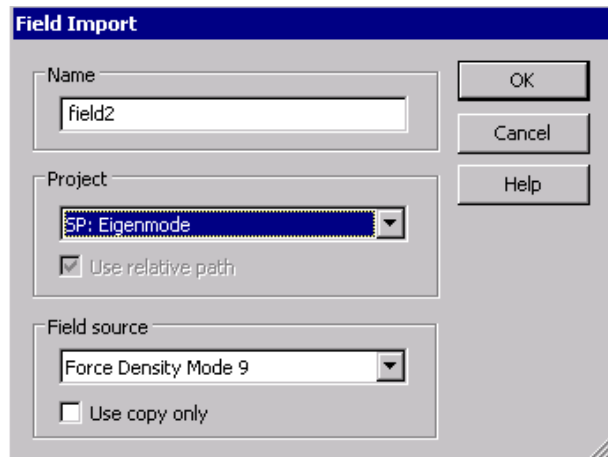
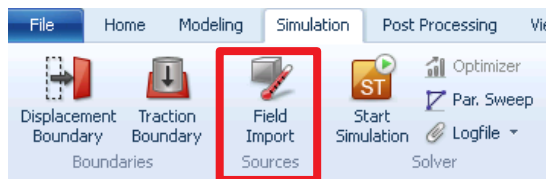
Модификации структуры

Для моделирования механических процессов необходимо задать стенки резонатора и их материал.



Material	Niobium
Type	Normal
Epsilon	1
Mu	1
Young's Mod.	105 [kN/mm ²]
Poiss.Ratio	0.4
Thermal Exp.	7.3 [1e-07/K]

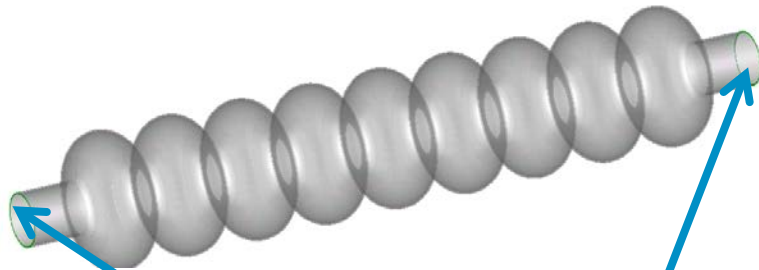
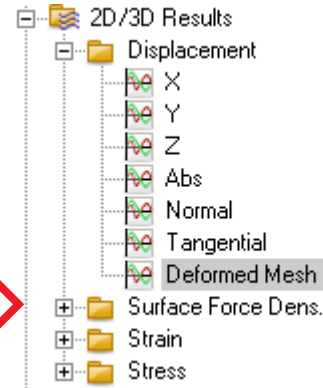
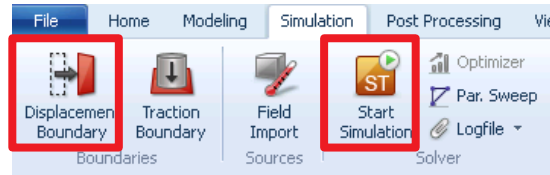
Загружаем плотность силы Лоренца



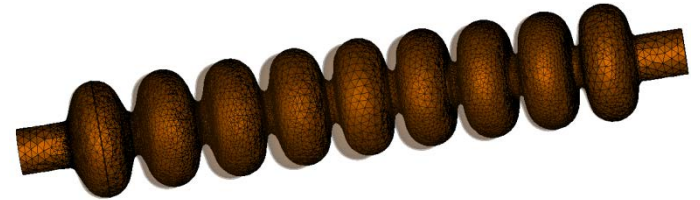
Загрузка плотности силы Лоренца из предыдущего проекта моделирования

Тип загружаемых данных определяется автоматически.

Установка ограничений и запуск солвера



Фиксация
структуры



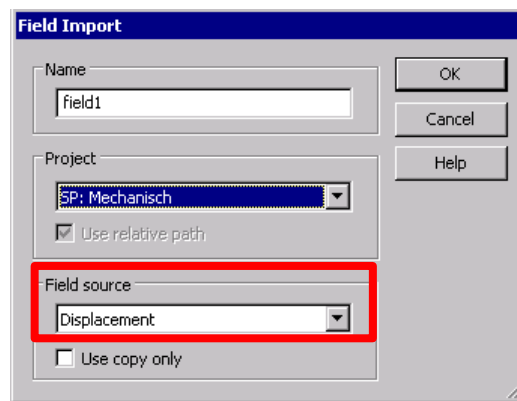
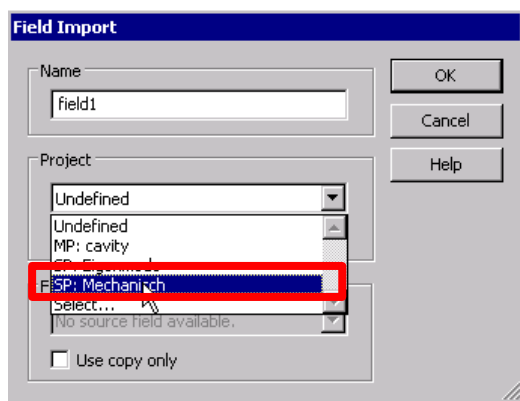
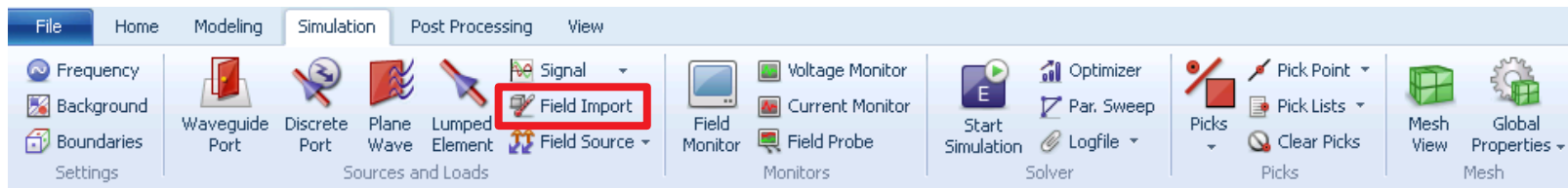
Проект моделирования для анализа чувствительности

The image shows the CST Microwave Studio software interface. The top ribbon includes tabs for File, Home, Post Processing, and View. The 'Simulation' section of the ribbon is highlighted with a red box, containing icons for 'New Task', 'Update', 'Optimizer', 'Par. Sweep', and 'Tune'. The 'Simulation Project' icon is specifically highlighted with a red box. Below the ribbon is the 'Navigation Tree' on the left, showing a project structure with folders like 'Drawing', 'Blocks', 'External Ports', 'Probes', 'Tasks', 'Eigenmode', 'Mechanisch', and 'Results'. The main workspace displays a 3D model of a blue cylindrical structure with a central hole, viewed from a perspective. A dialog box titled 'Create New Simulation Project' is open on the right, with the 'General' tab selected. The dialog contains the following fields and options:

- Name: Eigenmode-Sensitivity
- Use assembly information
- Project type: CST MICROWAVE STUDIO
- Project template: [None]
- Solver type: Eigenmode
- Reference model for global settings: SP: Eigenmode (with a 'Select...' button)
- Use reference block's coordinate system
- Link geometry to master model

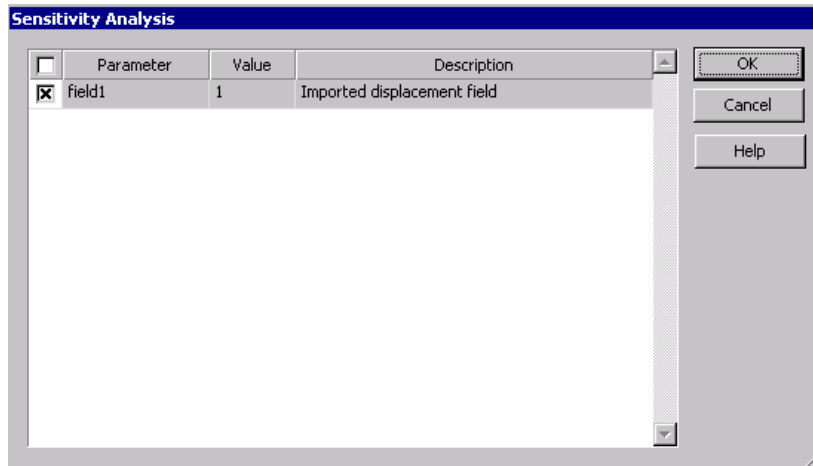
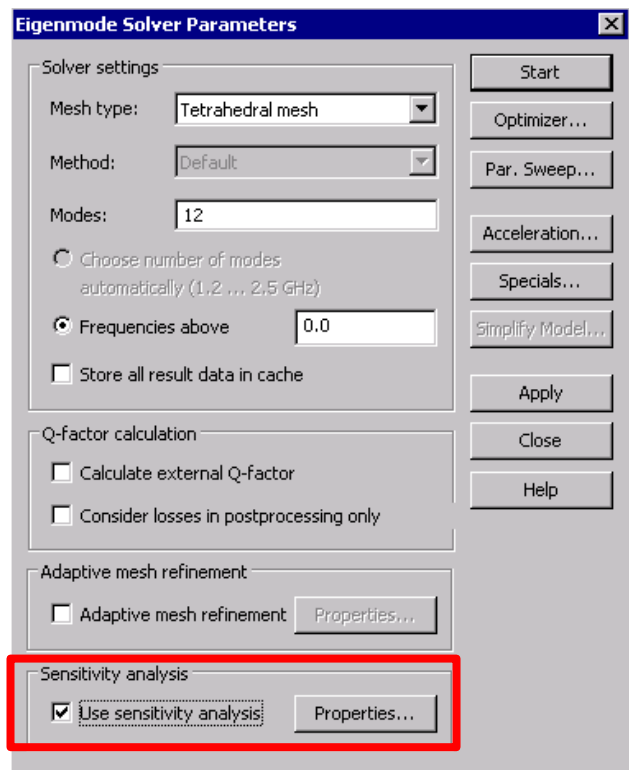
At the bottom of the dialog are 'OK', 'Cancel', and 'Help' buttons. The main workspace has '3D' and 'Schematic' tabs at the bottom.

Загрузка деформаций




Тип загружаемых данных
определяется автоматически

Активирование анализа чувствительности



Результаты

 Sensitivity analysis results:

Design parameter "field1" Mode	Frequency	Derivative of frequency	Est. displ. frequ.
1	1.277 GHz	8.844e-007 GHz	1.277 GHz
2	1.279 GHz	6.054e-007 GHz	1.279 GHz
3	1.283 GHz	5.833e-007 GHz	1.283 GHz
4	1.287 GHz	5.682e-007 GHz	1.287 GHz
5	1.291 GHz	5.51e-007 GHz	1.291 GHz
6	1.295 GHz	5.383e-007 GHz	1.295 GHz
7	1.298 GHz	5.37e-007 GHz	1.298 GHz
8	1.3 GHz	2.515e-007 GHz	1.3 GHz
9	1.301 GHz	4.754e-007 GHz	1.301 GHz
10	2.289 GHz	3.102e-007 GHz	2.289 GHz
11	2.299 GHz	1.557e-006 GHz	2.299 GHz
12	2.301 GHz	1.096e-006 GHz	2.301 GHz