



Flux 建立稳态场异步电机模型操作流程

北京天源博通科技有限公司
www.tianyuantech.com

[说明：本操作流程是按照 Flux_10.3_Doc_examples\Examples2D\InductionMotor 作为参考，具体参数请参见源文档]

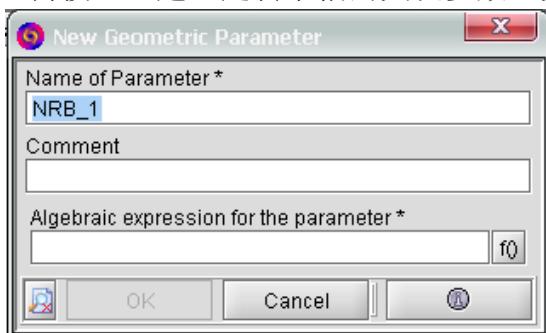
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一、建模

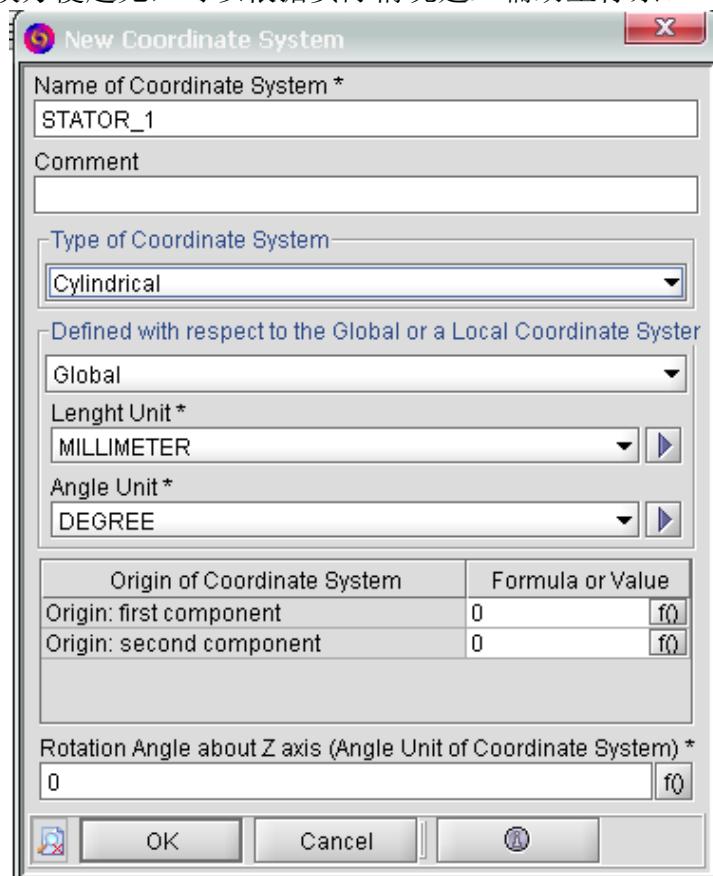
1、定义参数

根据电机的几何模型，建立定转子槽的关键参数，如槽宽、槽高等...



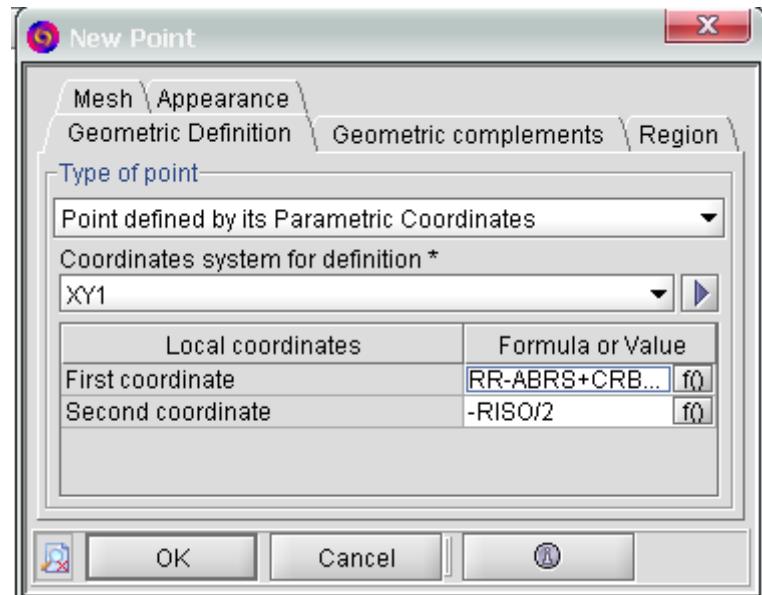
2、新建坐标系（定转子旋转坐标系及 XY1）

为建模方便起见，可以根据实际情况建立辅助坐标系。



3、建立定转子槽模型（注意选取参考系）

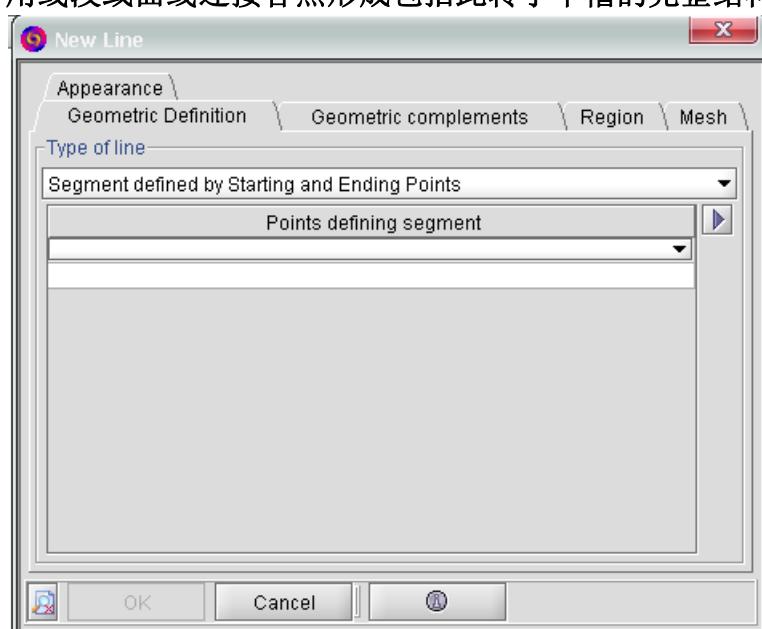
3.1 建立转子半个槽的关键节点

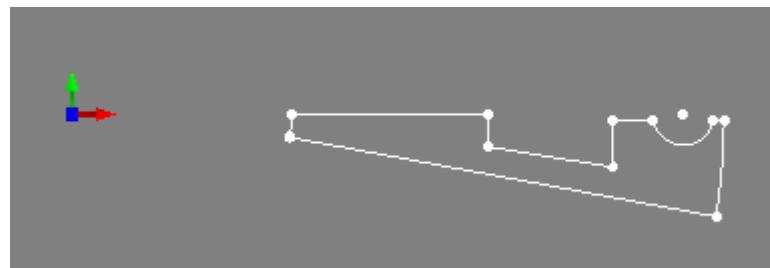


3.2 完成包括此半槽的转子结构上所需点



3.3 用线段或曲线连接各点形成包括此转子半槽的完整结构

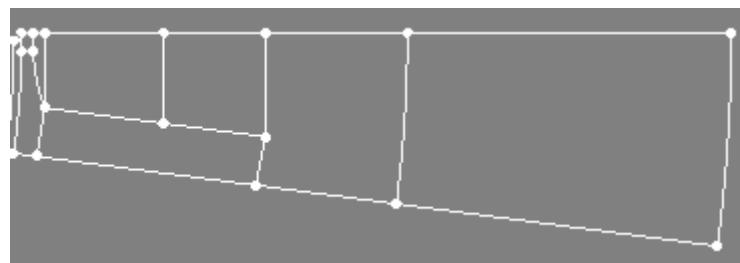




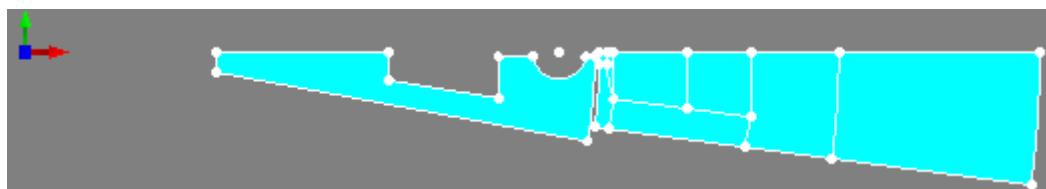
3.4 建立定子槽半槽的点



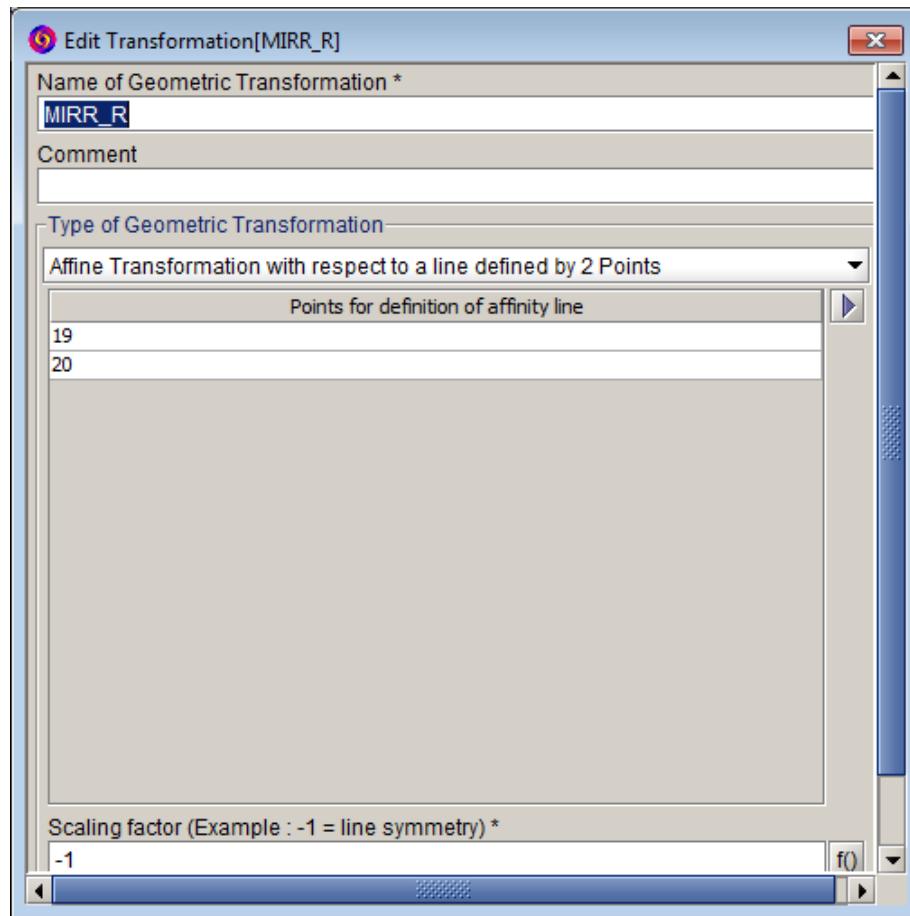
3.5 用线段或曲线连接各点形成包括此转子半槽的完整结构



3.6 闭合曲线围成面

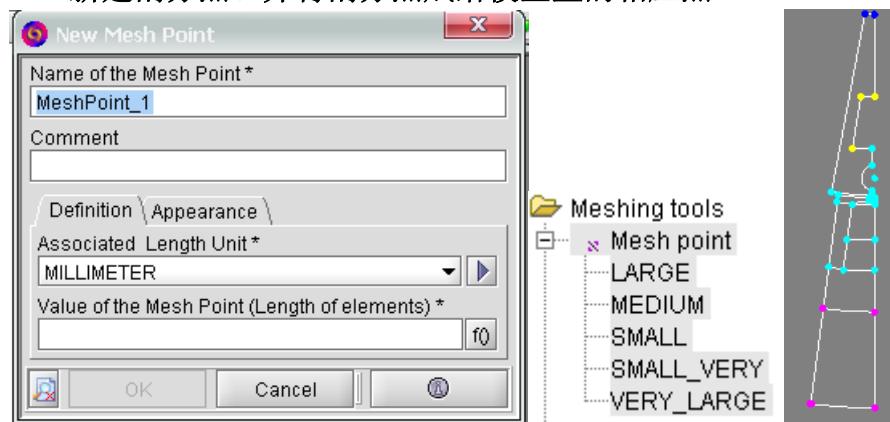


4、生成镜像、复制规则，以便在后续步骤中生成全模型

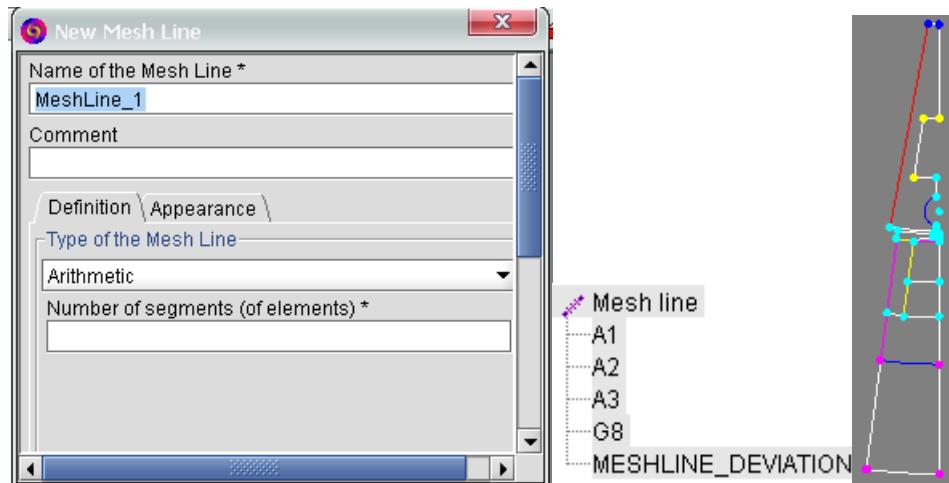


5、基本剖分（很多时候自动剖分即可）

5.1 新建剖分点、并将剖分点赋给模型里的相应点

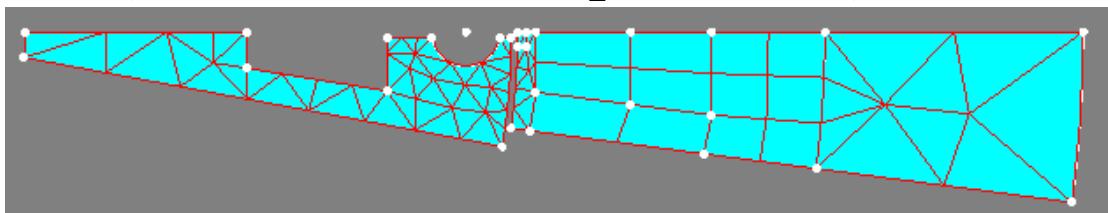


5.2 新建剖分线、并将剖分点赋给模型里的相应线

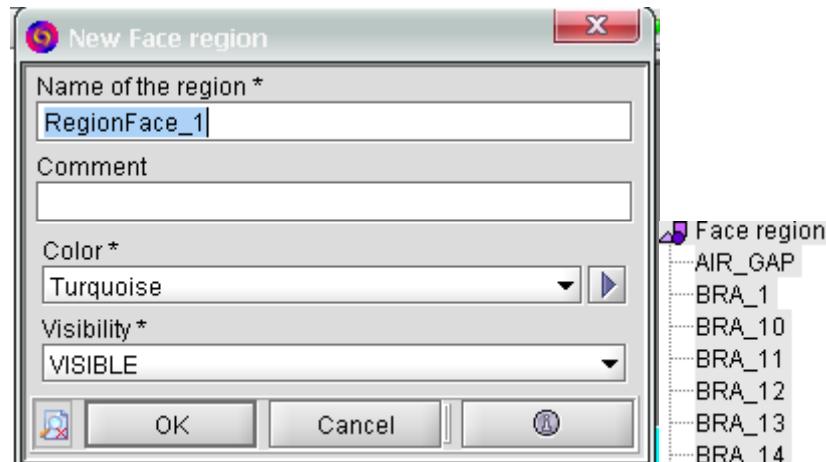


5.3 选择适当的面进行映射剖分 (assign mapped mesh generator)

注意，映射剖分需要选择由四条线组成的面。如果目标面是由超过 4 条线组成的，则可以通过 structure_faces 重新设定 4 条目标面的包围线。

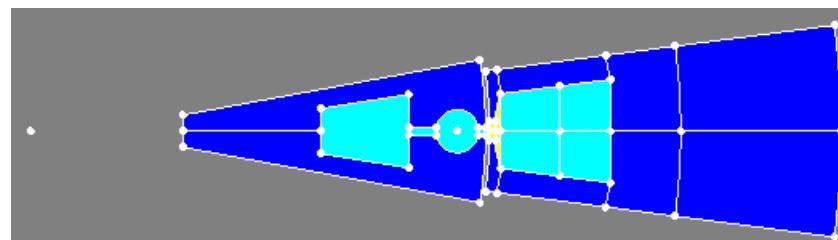
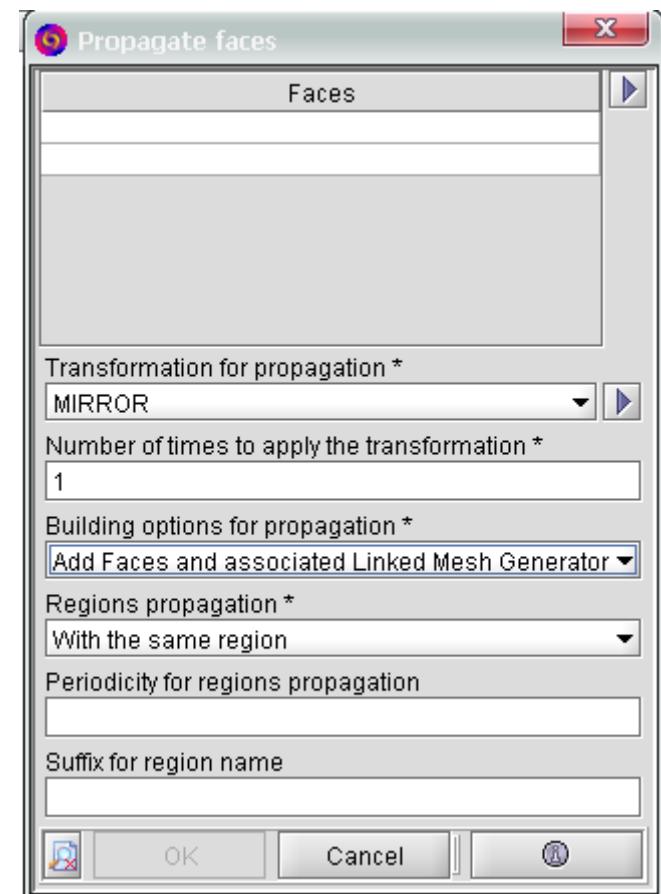


6、新建 region，并适当的赋给符合条件的面（视情况而定）



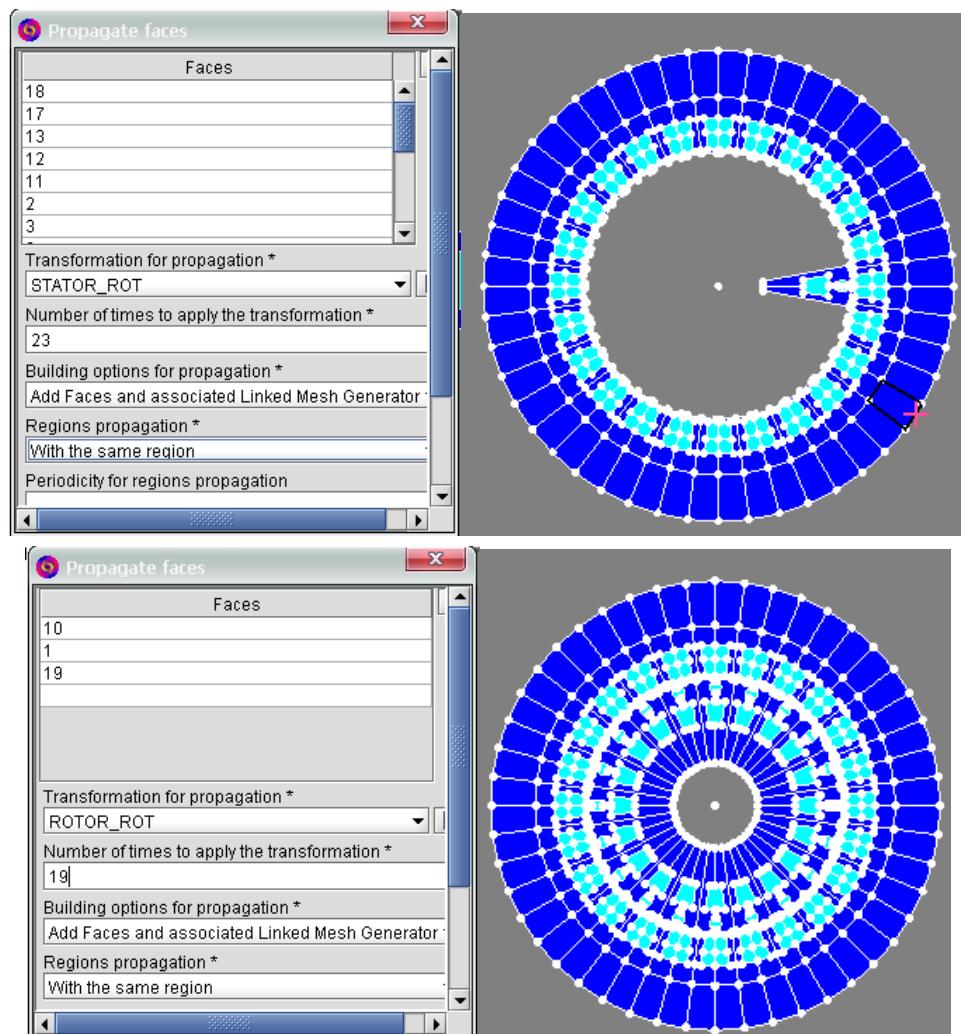
7、生成电机截面全模型

7.1 通过 MIRROR 复制生成定转子完整槽结构

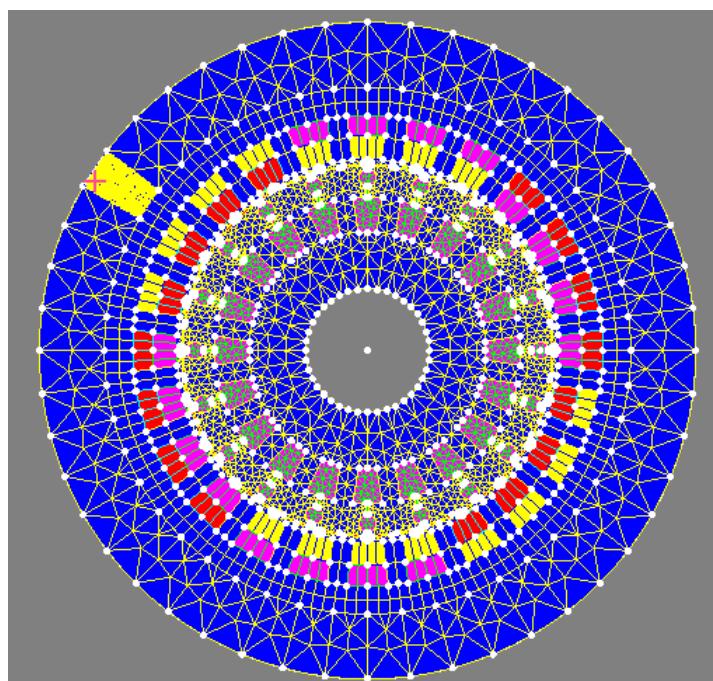


注意：如果定转子槽是开口槽，而且没有槽楔的话，需新建曲线（以转轴中心为圆心）将槽口闭合，以区分气隙与定转子槽内导体。

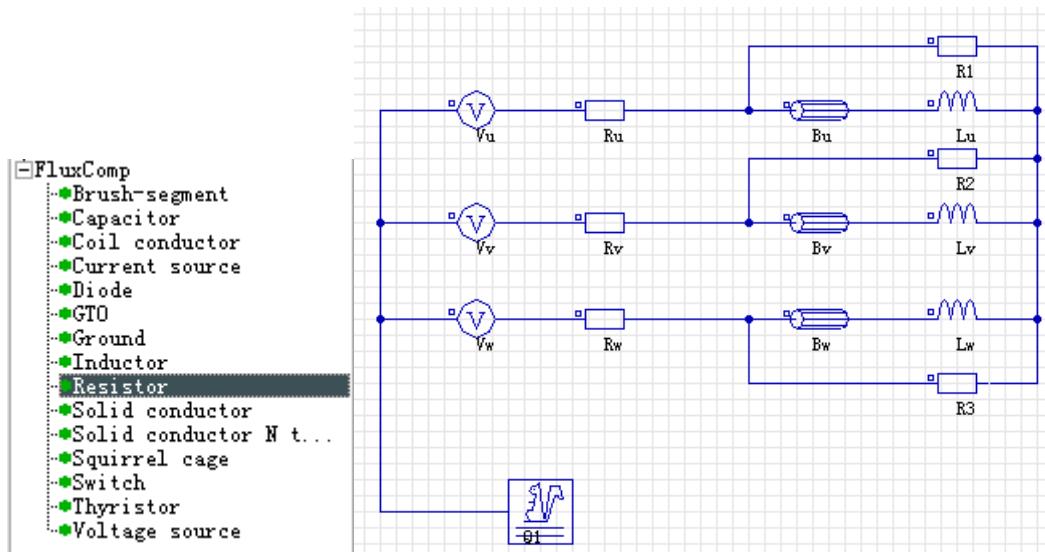
7.2 通过 rotor_rot 与 stator_rot 将定转子槽在一个圆周内复制（或一极下）



8、将剩下未定义的面上赋上相应的 region

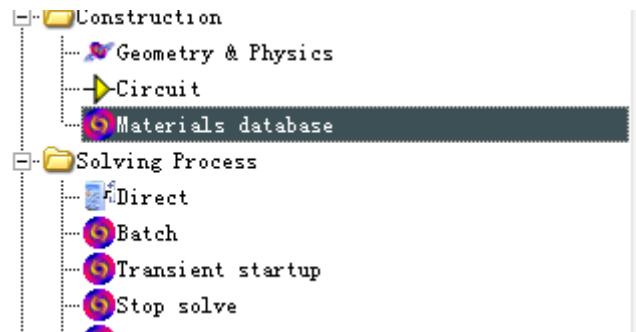


9、建立外部电路模型



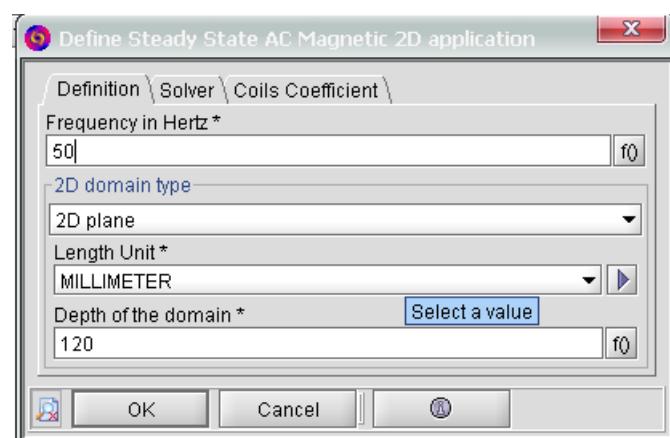
10、自定义材料

ADD → material (材料名+描述) → 1 iso MU / 3 ISO RHO



11、选择求解器类型

11.1、设定求解器

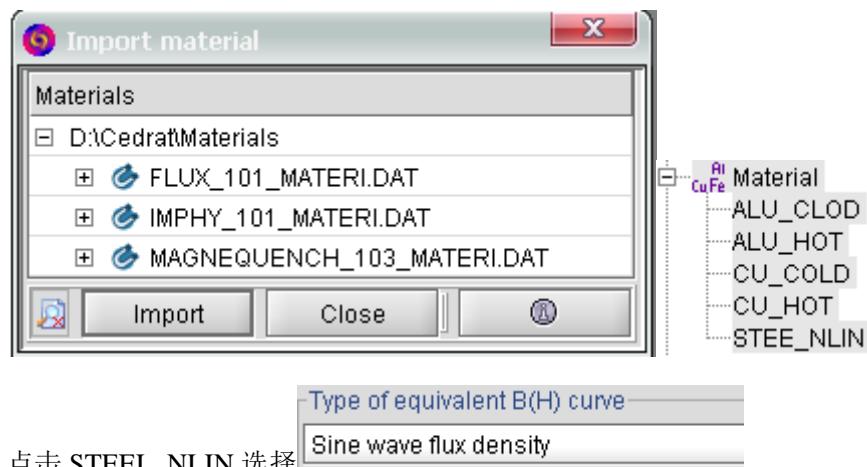


11.2、设置模型的物理参数

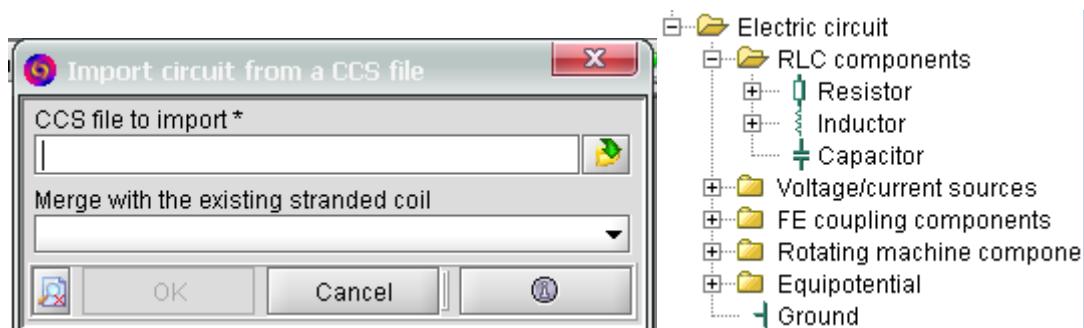
11.2.1、更改界面模式为物理模式



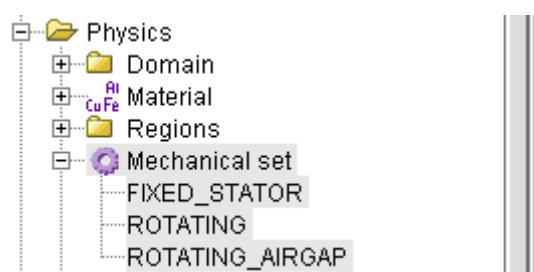
11.2.2、导入材料

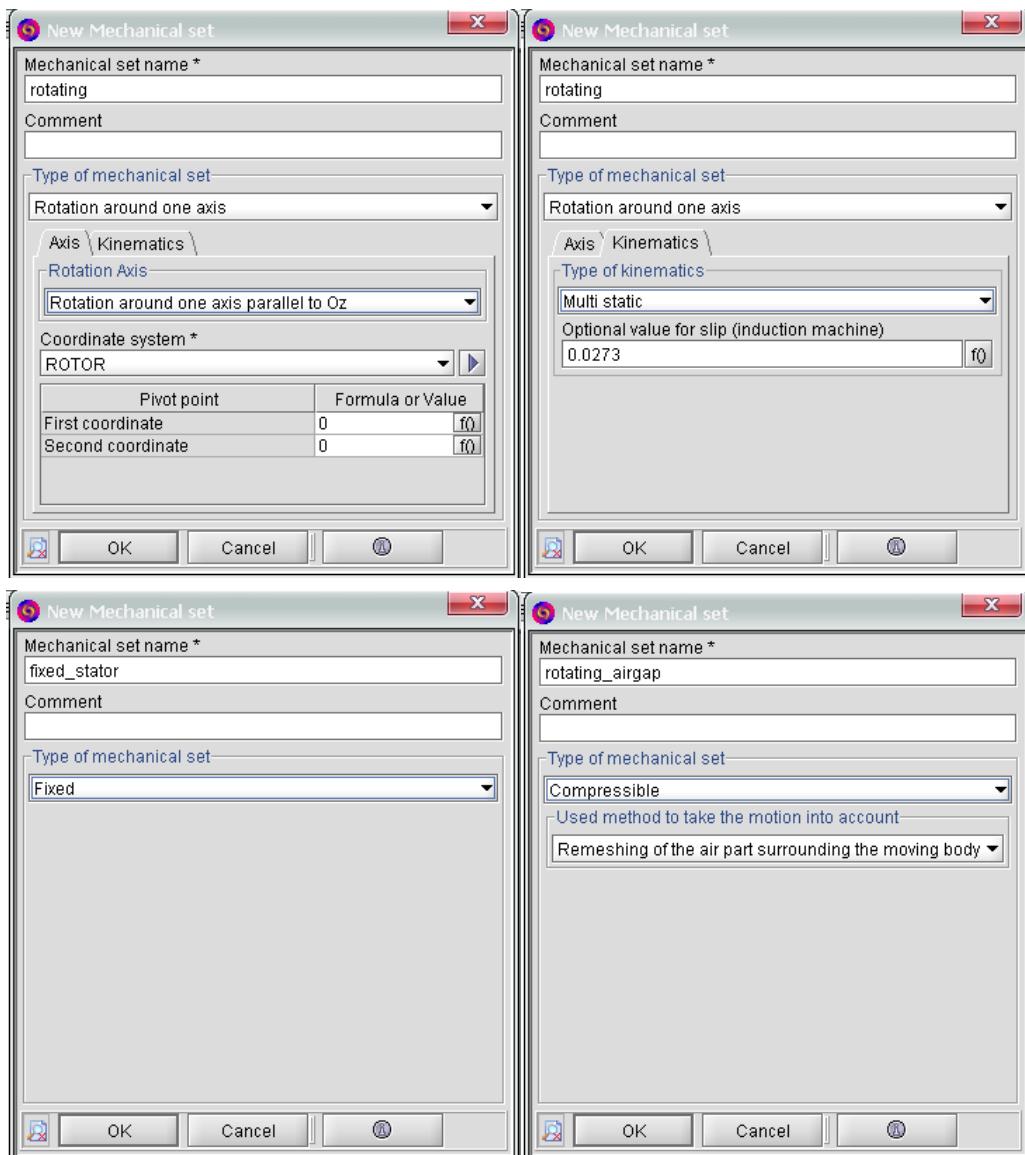


11.2.3、导入电路模型，给电路相关器件赋值



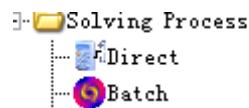
12、机械设定



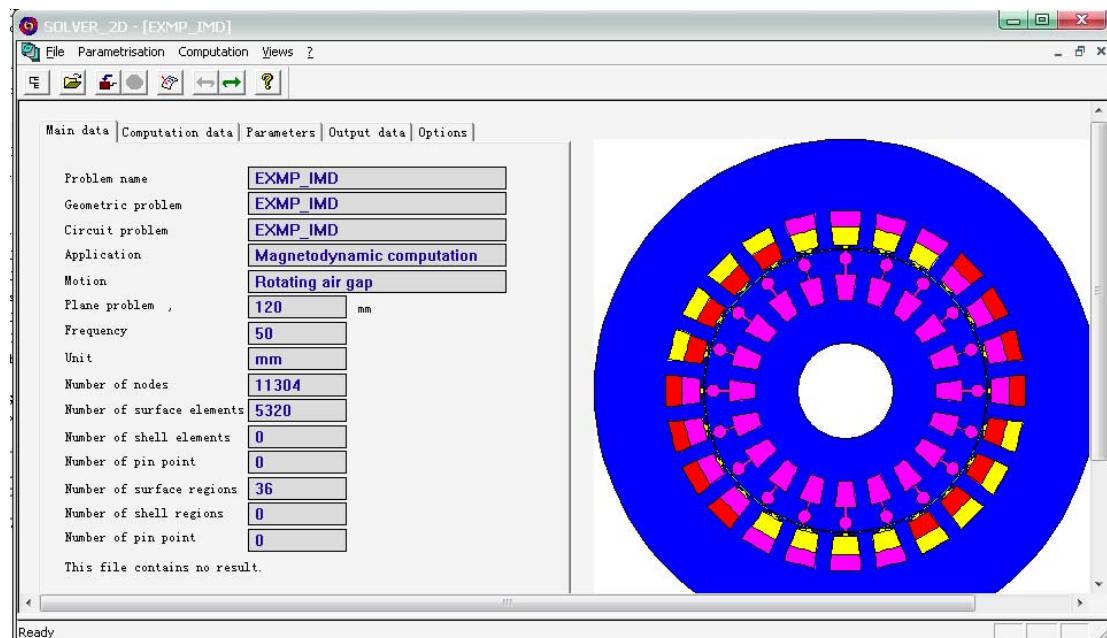


设置完成后将电路相关器件、运动设置以及材料属性赋给各 regions

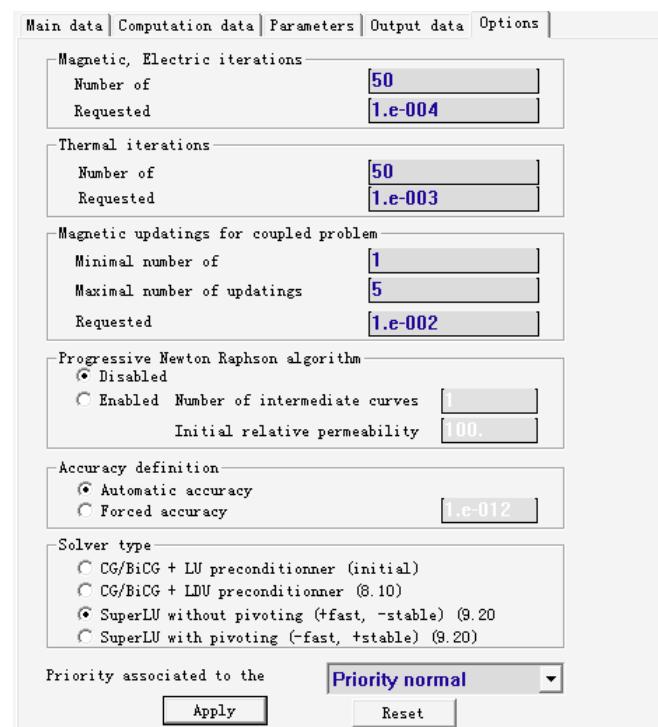
二、求解



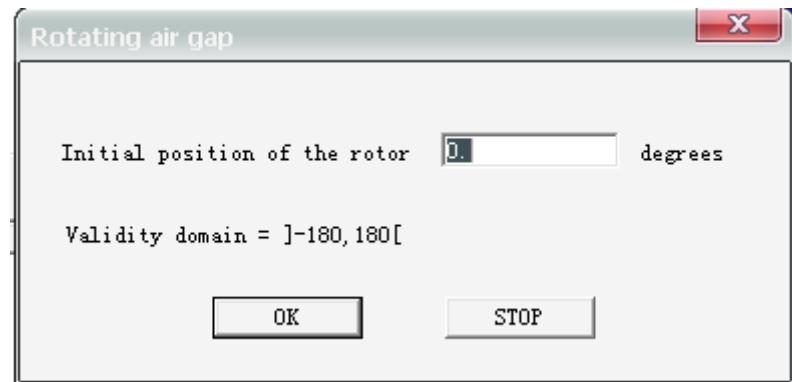
1、Direct Mode



1.1 设定 Options



1.2 点击 solve button

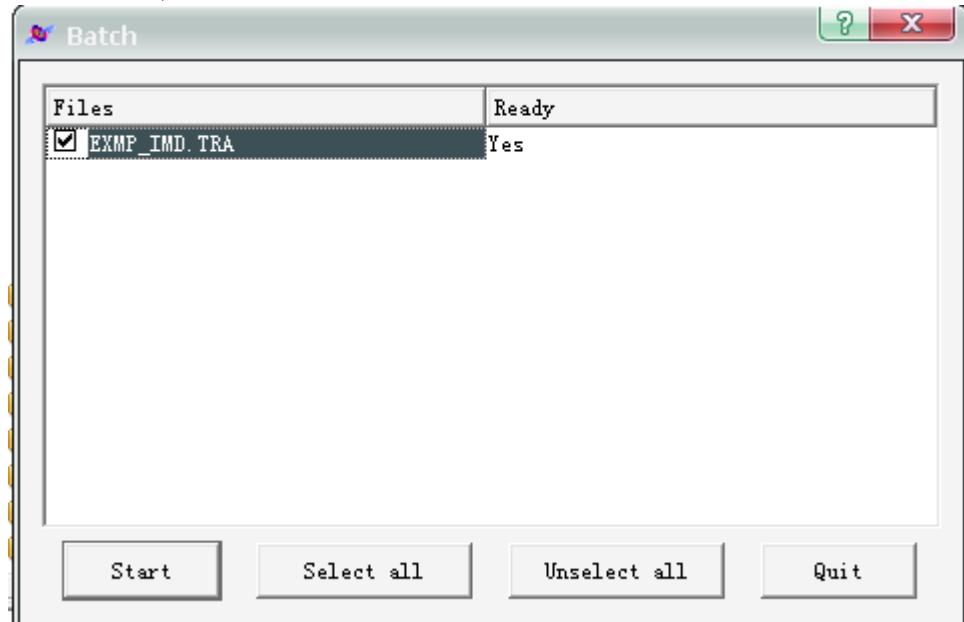


1.3 计算结束，点 exit 退出

2、Batch Mode (第二种求解方法，此法可同时求多个工程文件)

2.1 在 Direct 中准备批处理文件 

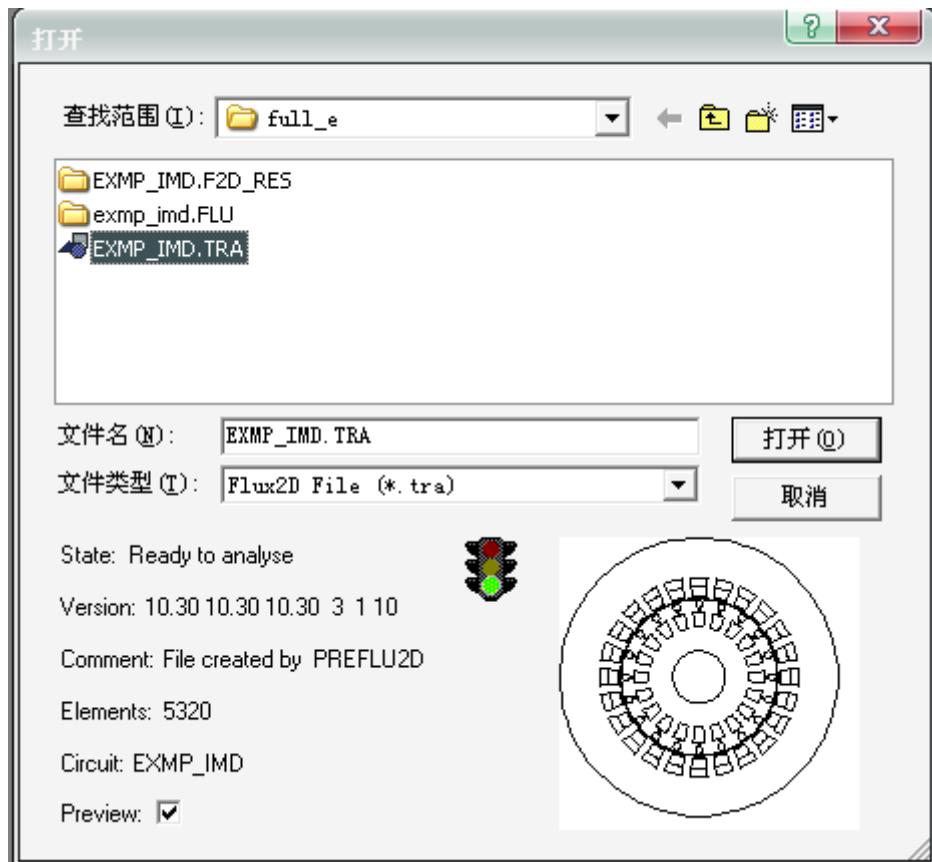
2.2 点击 Batch, 选择刚才生成的批处理文件



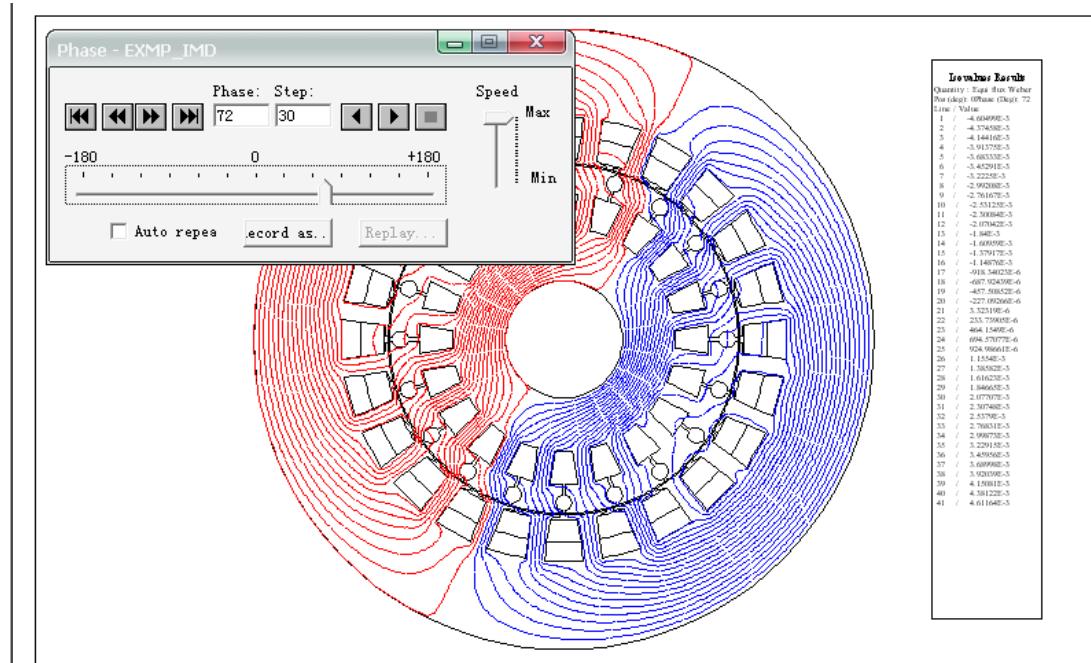
2.3 计算完成，关闭对话框

三、查看并分析结果

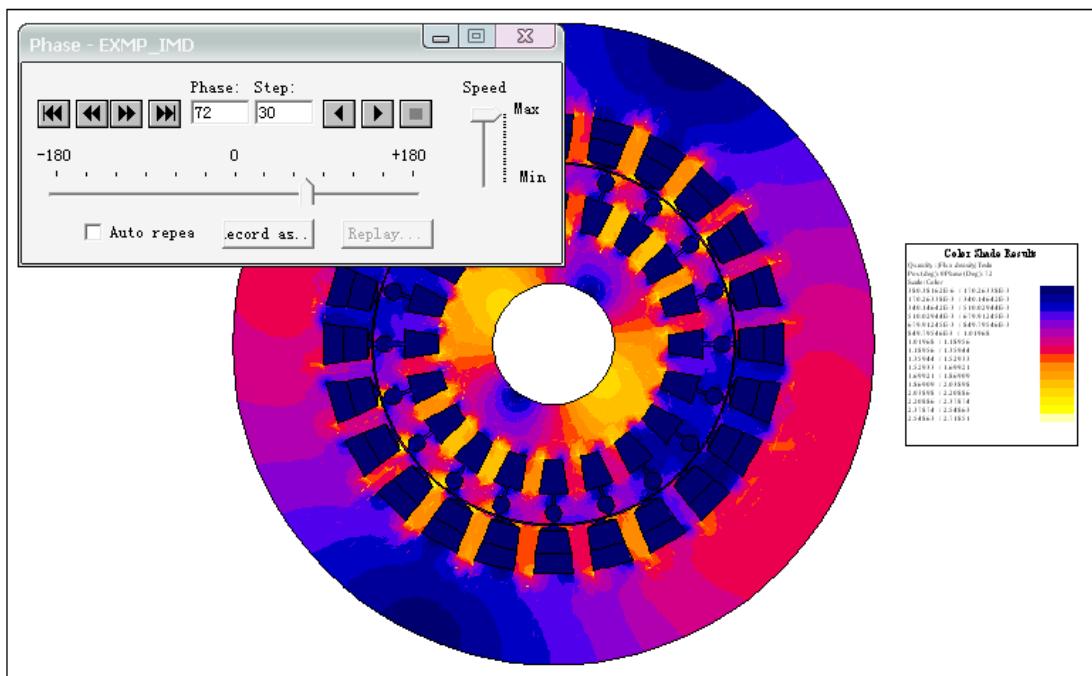
1、双击 result，打开刚才计算过的文件



2、磁感线

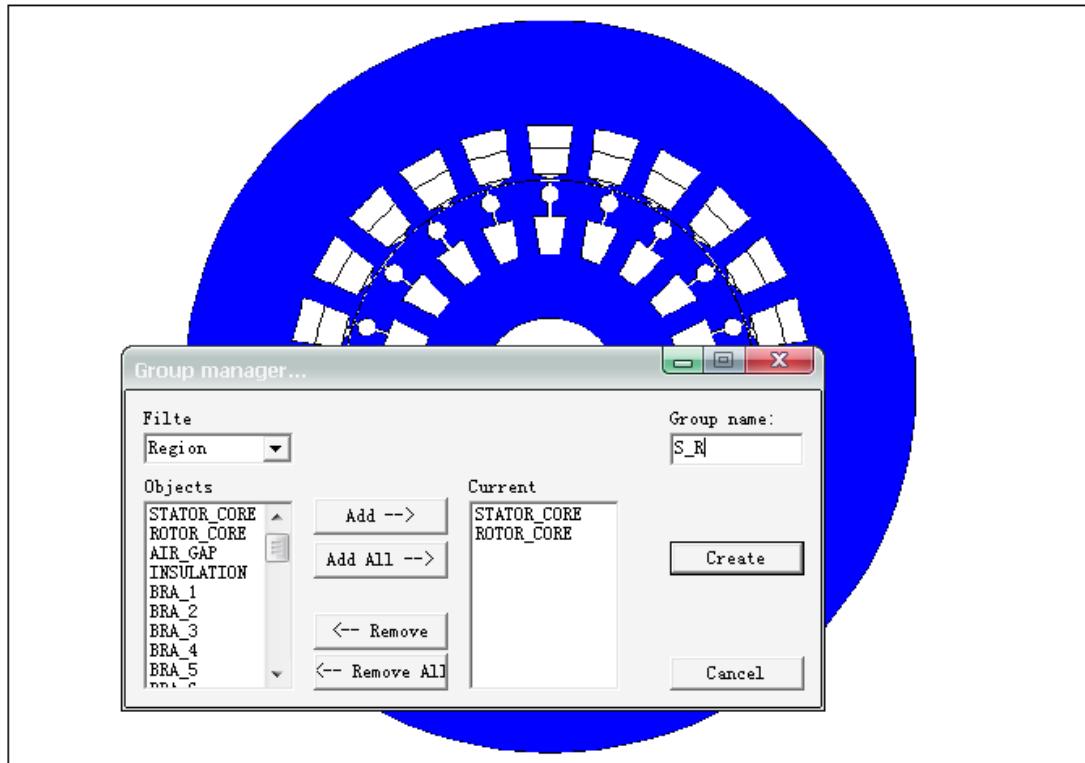


3、磁密

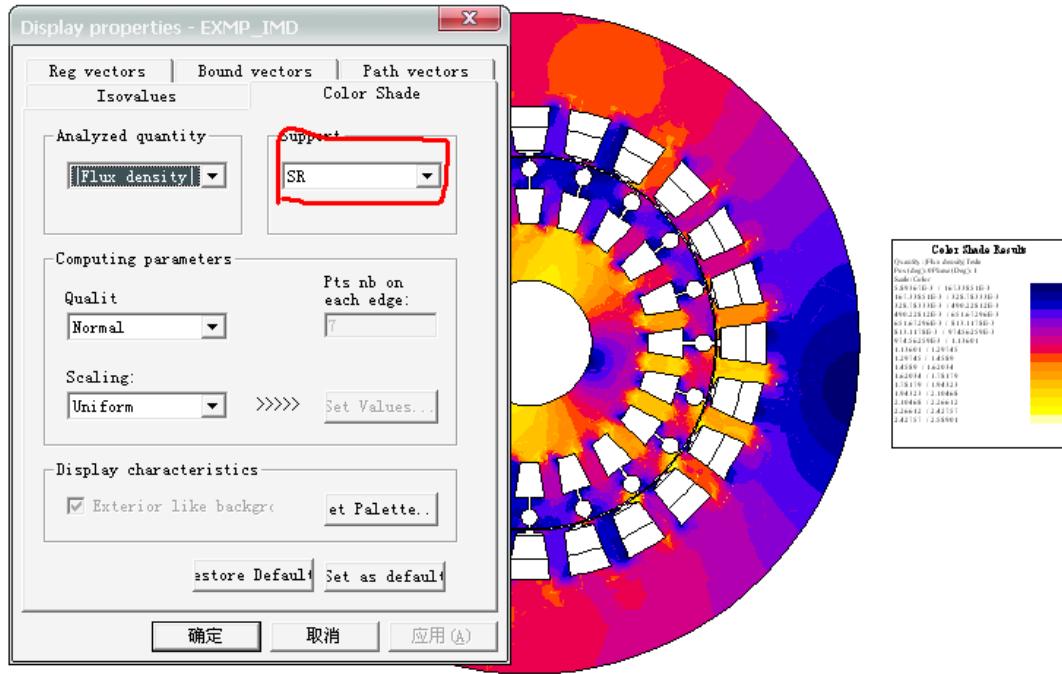


4. 定义所关心的面域查看磁密

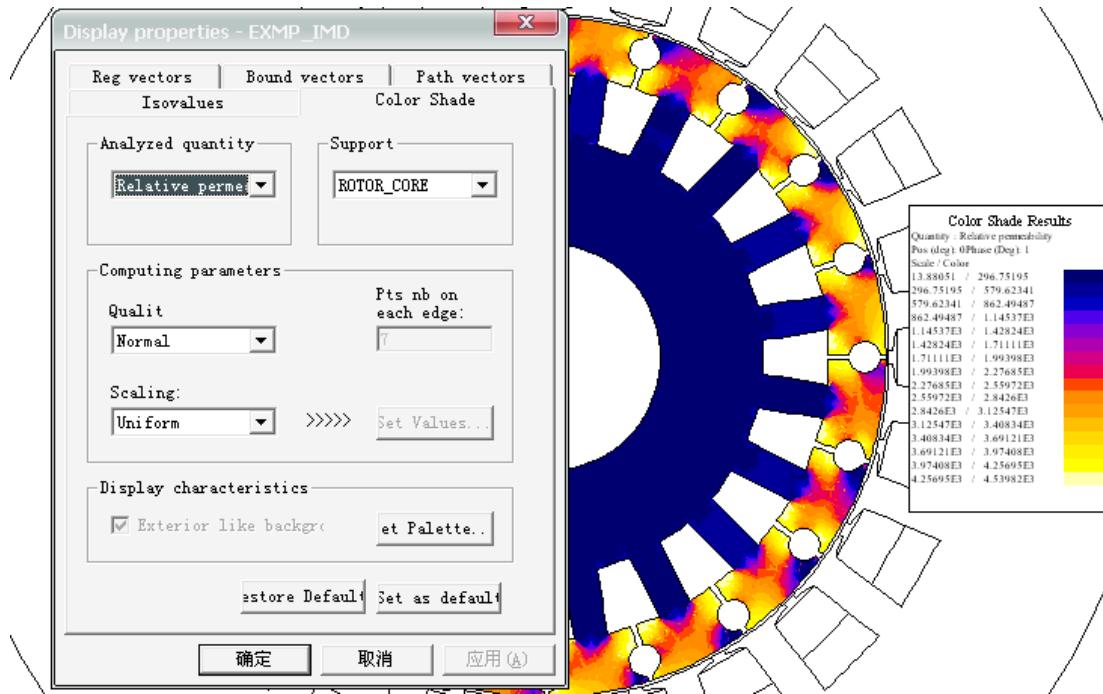
4.1 通过 groups manager 来建立面域



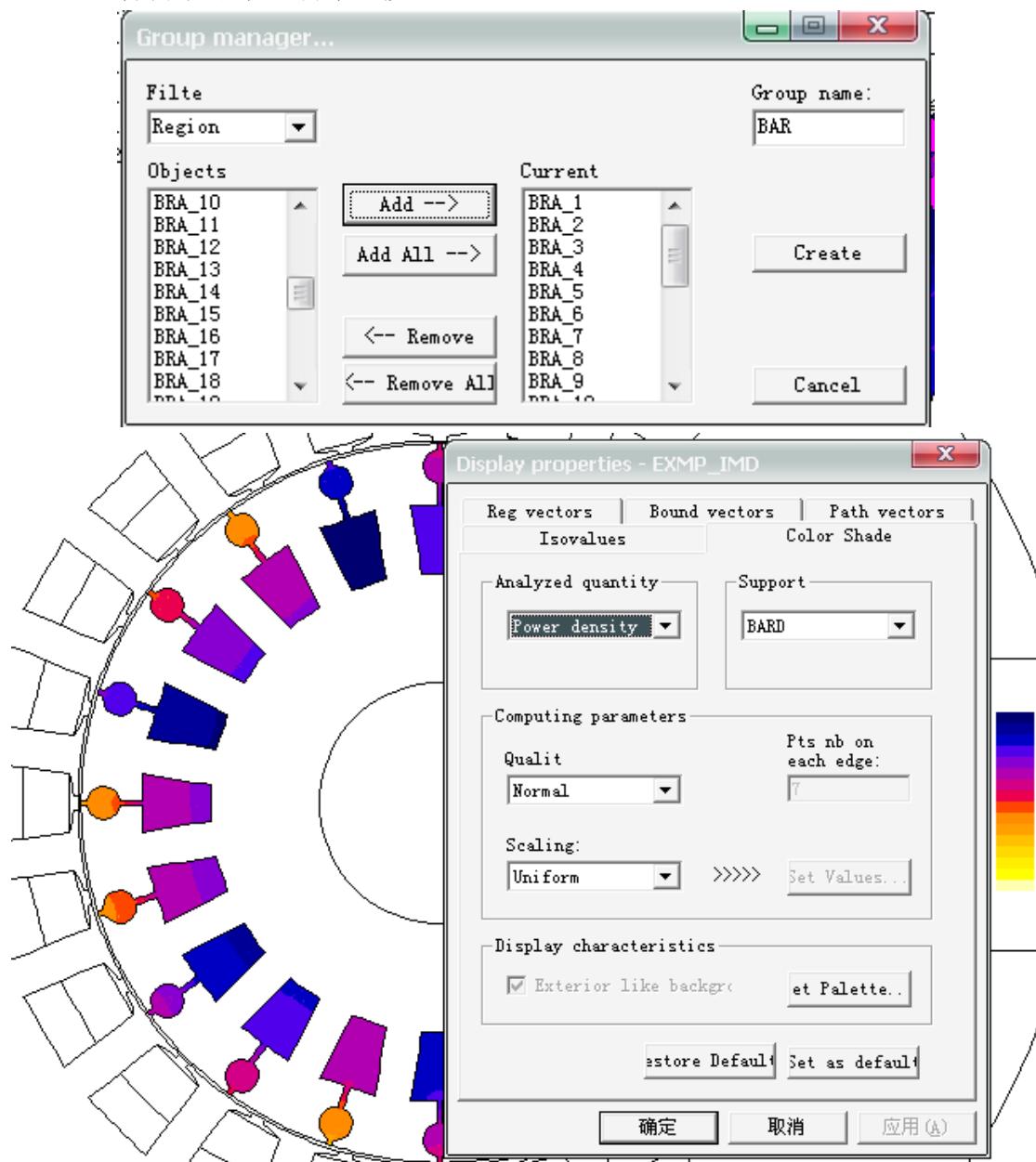
4.2 查看此面域上的物理量



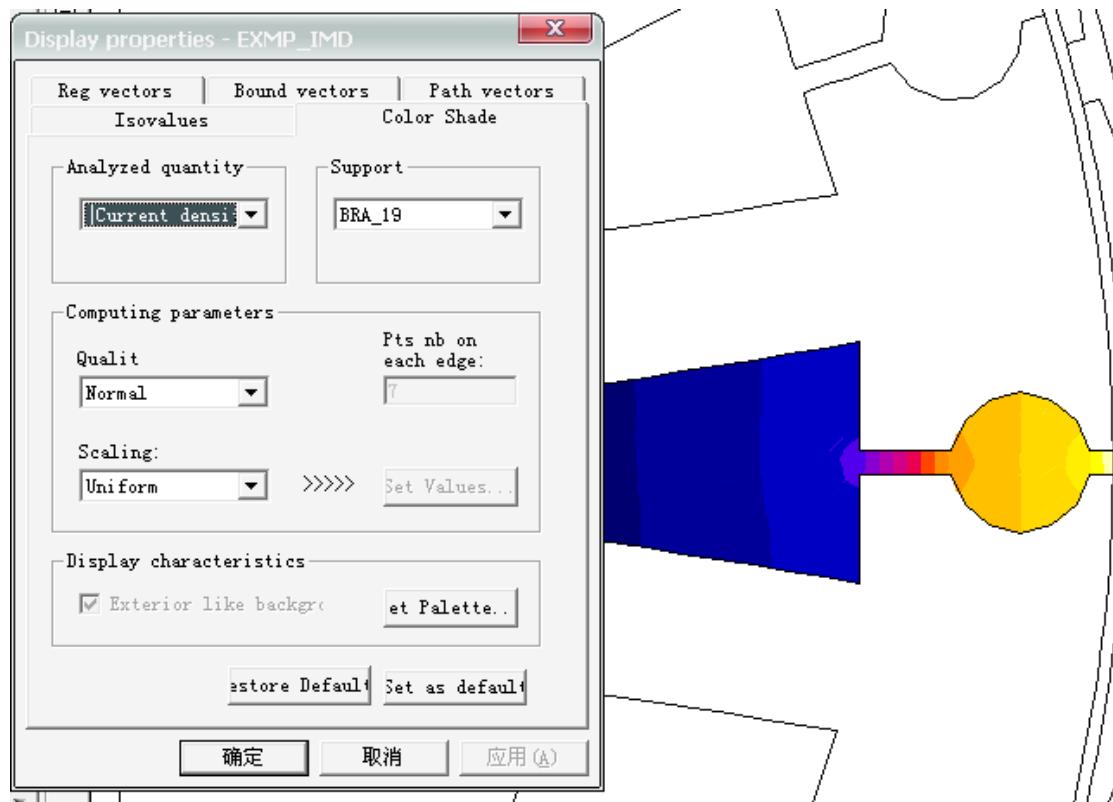
5. 查看饱和分布图



6.查看转子导条的功率密度

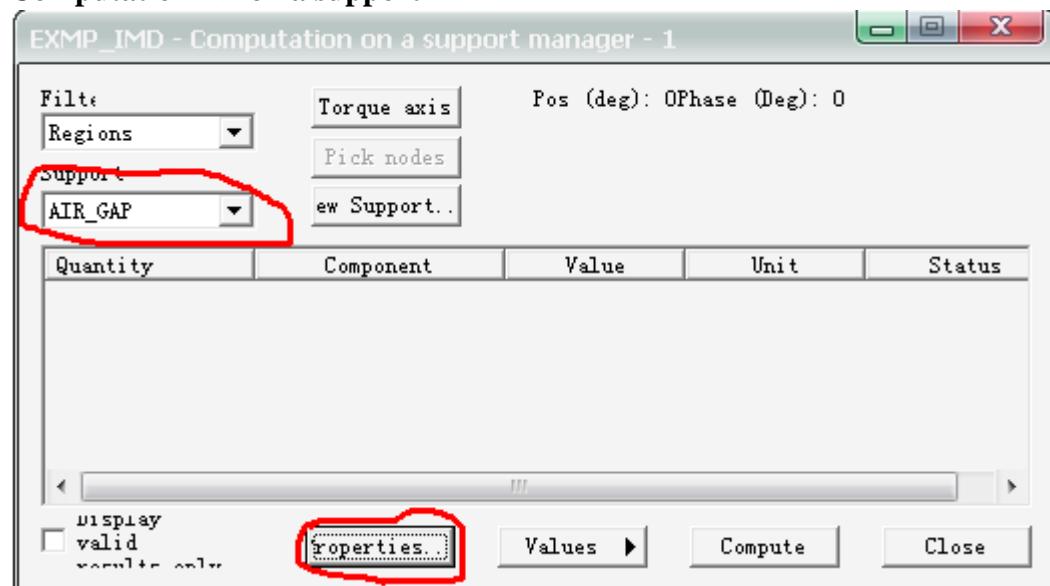


7.查看某一根导条上的电流密度



8.计算转矩值

Computation—> on a support



Computation properties - EXMP_IMD

Computation	Coefficients	
Quantity: Force Torque Laplace's Geometry Current Power Inductance Magnetic pr Magnetic te	Component: Moment	User's Torque / Moment
<input type="button" value="Add -->"/> <input type="button" value="Add All -->"/> <input type="button" value="-- Remove All"/> <input type="button" value="Remove"/>		
<input type="button" value="确定"/> <input type="button" value="取消"/>		

EXMP_IMD - Computation on a support manager - 1

Filter	Torque axis	Pos (deg): 0	Phase (Deg): 1
Regions	Pick nodes		
Support	New Support...		
AIR_GAP			
Quantity	Component	Value	Unit

Result:

Quantity	Component	Value	Unit	Status
Torque	Moment	20.31504	Newton.m	OK

Buttons at the bottom:

- Display
- valid results only
-
-
-
-

注意：如果模型是只取了其中一极，则结果应乘以 2p

9.计算每相的电流和功率

Computation properties - EXMP_IMD

Quantit:	Component:	User's
Geometry	Rms current	Circuit / Phase Voltage
Current	Active power	Circuit / Rms voltage
Power	Reactive power	Circuit / Phase Current
Inductance	Magnitude I	Circuit / Rms current
Magnetic pr.	Real part I	Circuit / Active power
Magnetic to	Imag part I	Circuit / Reactive power
Circuit	Phase Flux	Circuit / Magnitude Flux
Scalar iron	Rms flux	

EXMP_IMD - Computation on a support manager - 2

Filter	Torque axis	Pos (deg): 0	Phase (Deg): 1
Electrical com	Pick nodes		
Support	New Support...		
VU			

Quantity	Component	Value	Unit	Status
Circuit	Phase Voltage	0	Degree	OK
Circuit	Rms voltage	380.00003	V. rms	OK
Circuit	Phase Current	140.28421	Degree	OK
Circuit	Rms current	7.972764	A. rms	OK
Circuit	Active power	-2.330478E3	VA	OK
Circuit	Reactive power	-1.035985E3	Var	OK

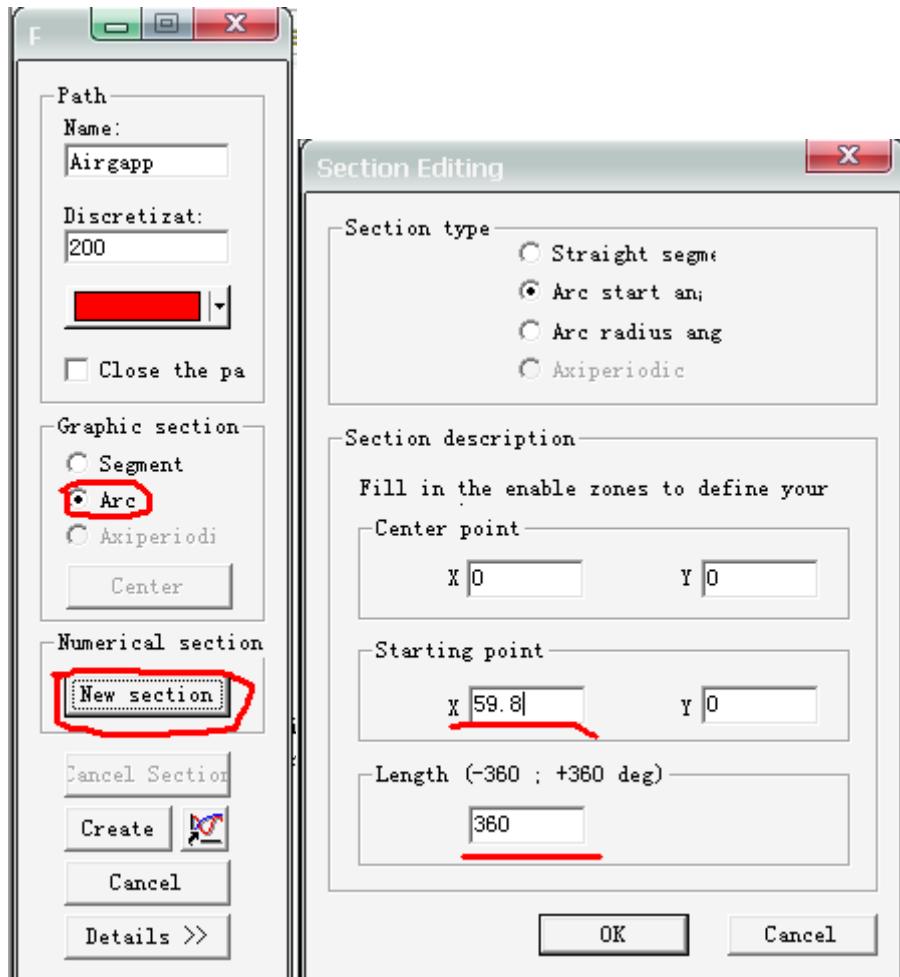
Display
 valid results only Properties... Values ► Compute Close

10.保存上两步的计算结果

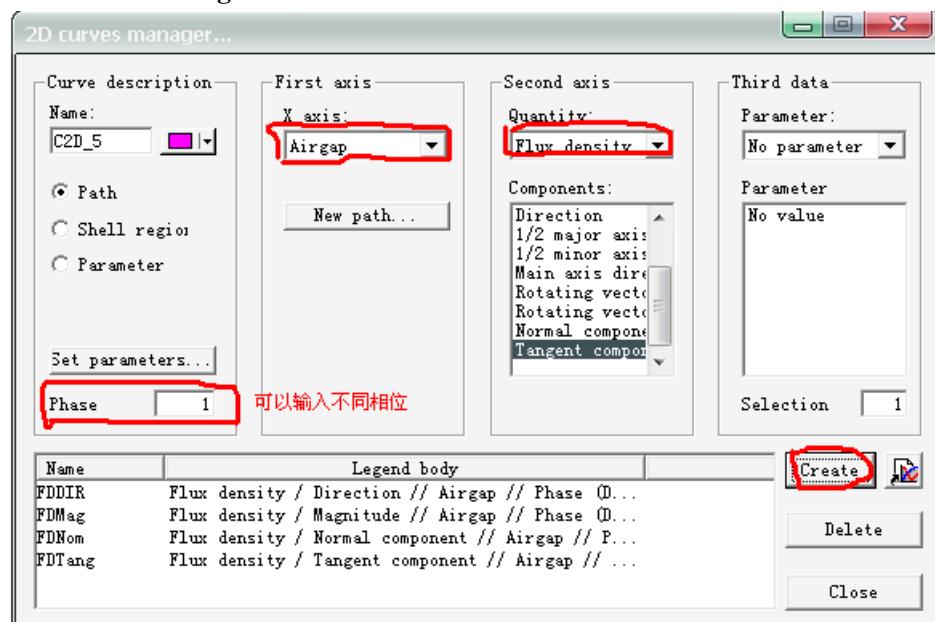
View -> save review file as

11. 分析气隙中的磁密

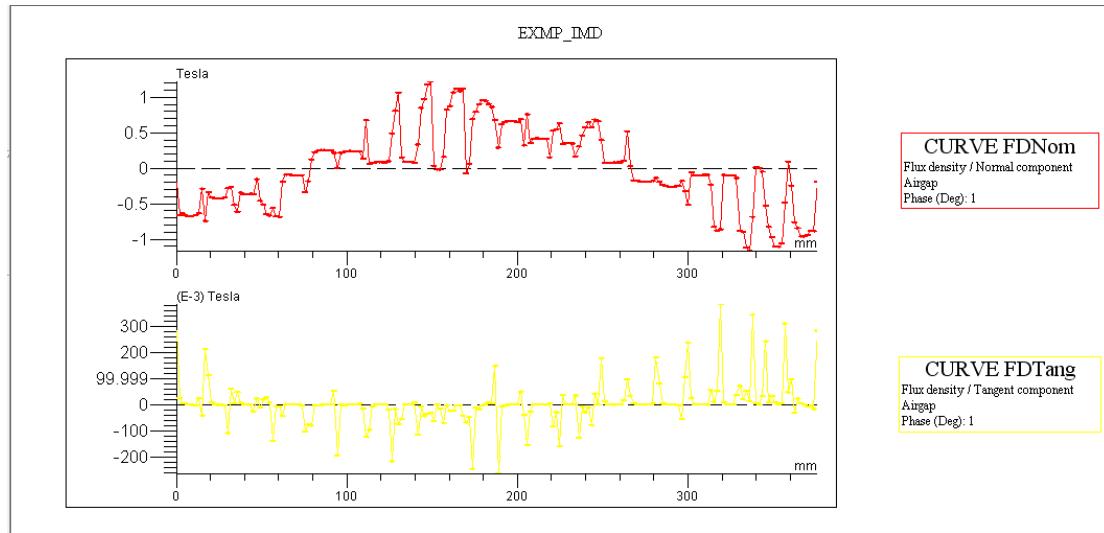
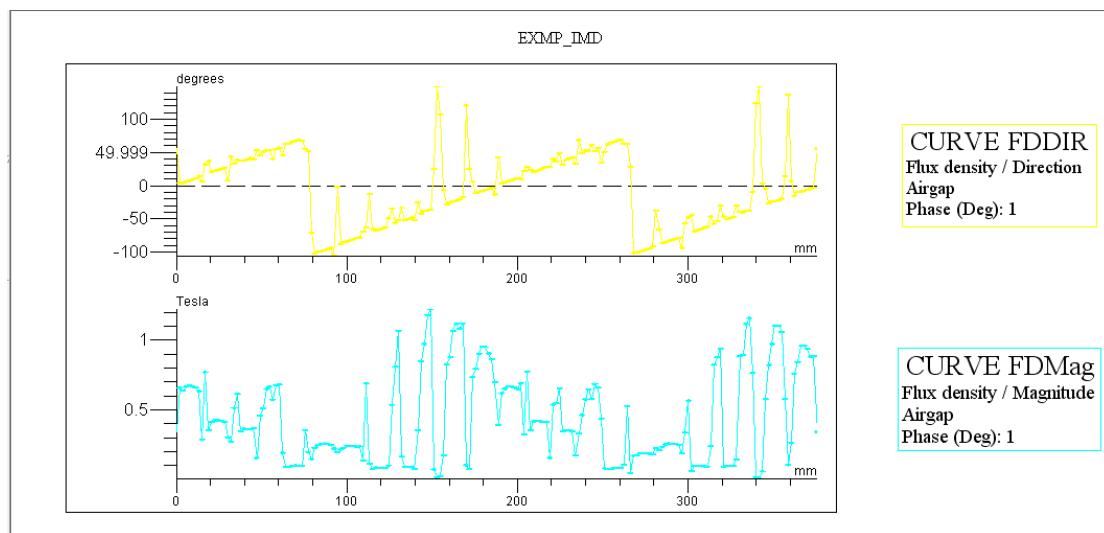
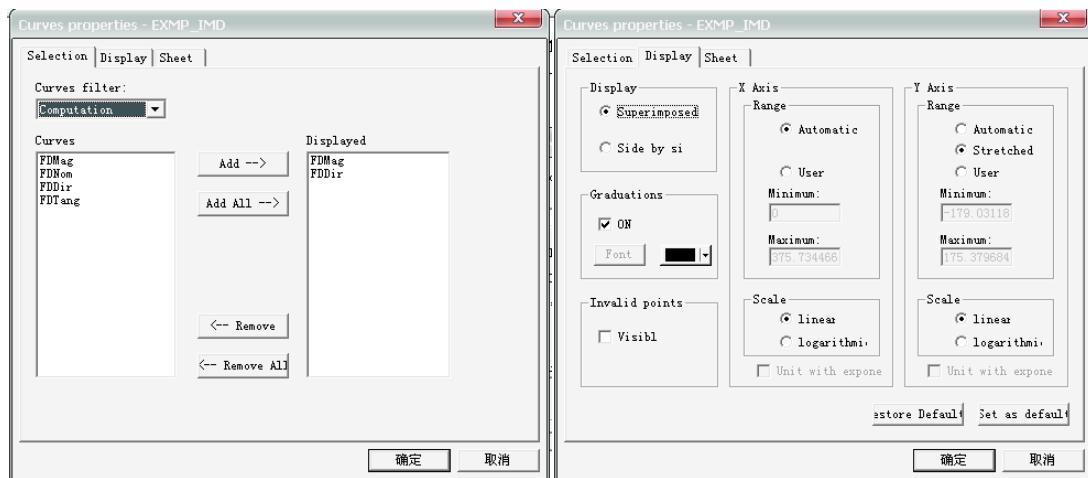
Supports -> path manager



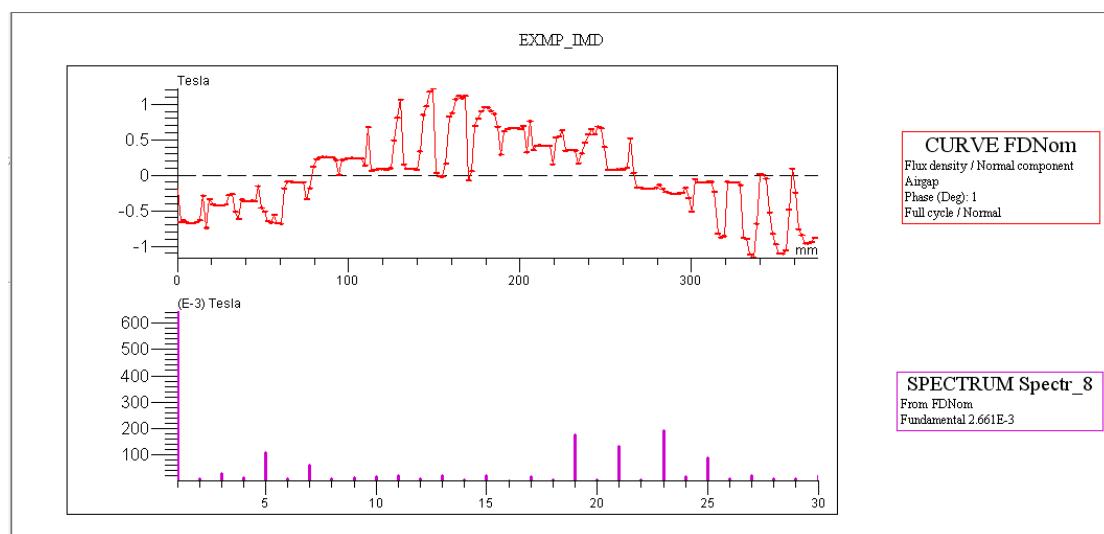
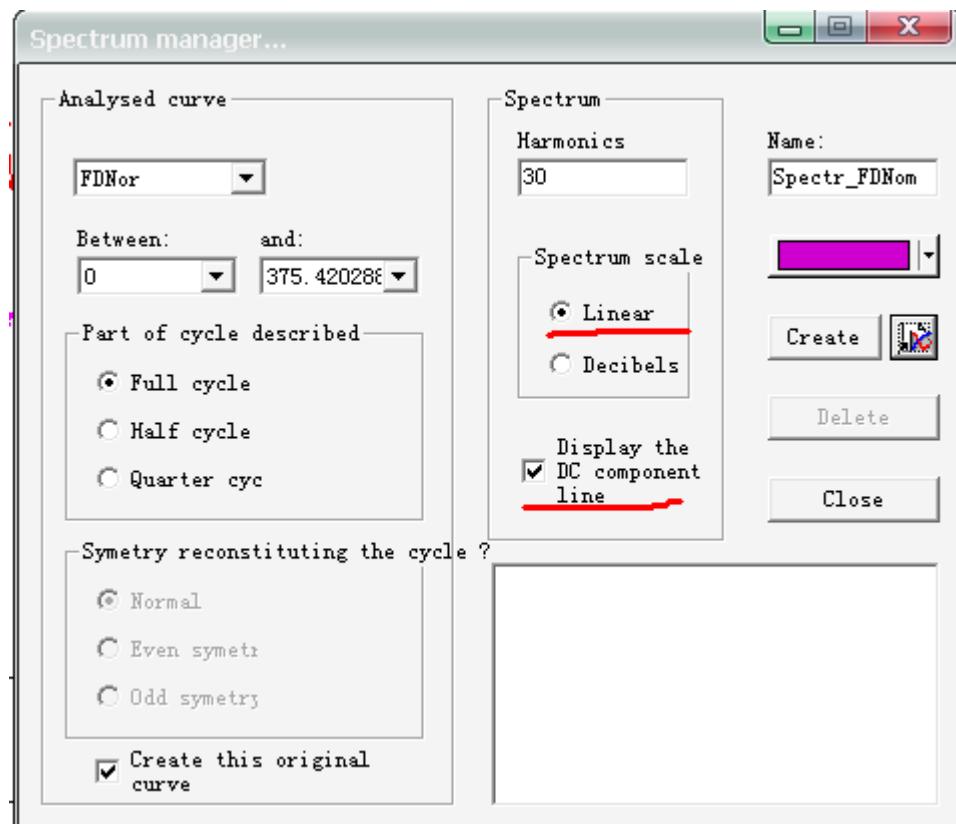
2D curve manager



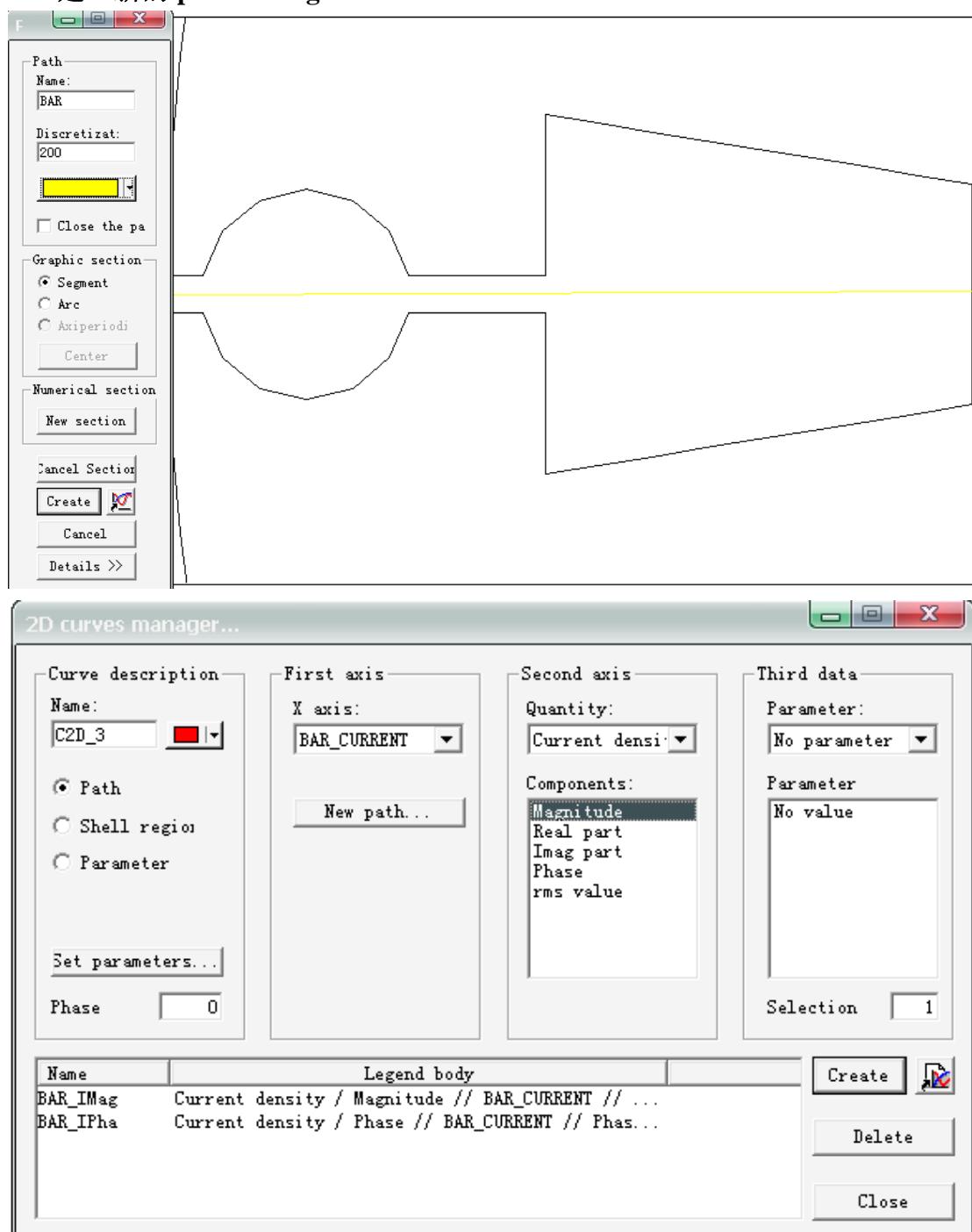
New 2D curves sheet -> Curves properties

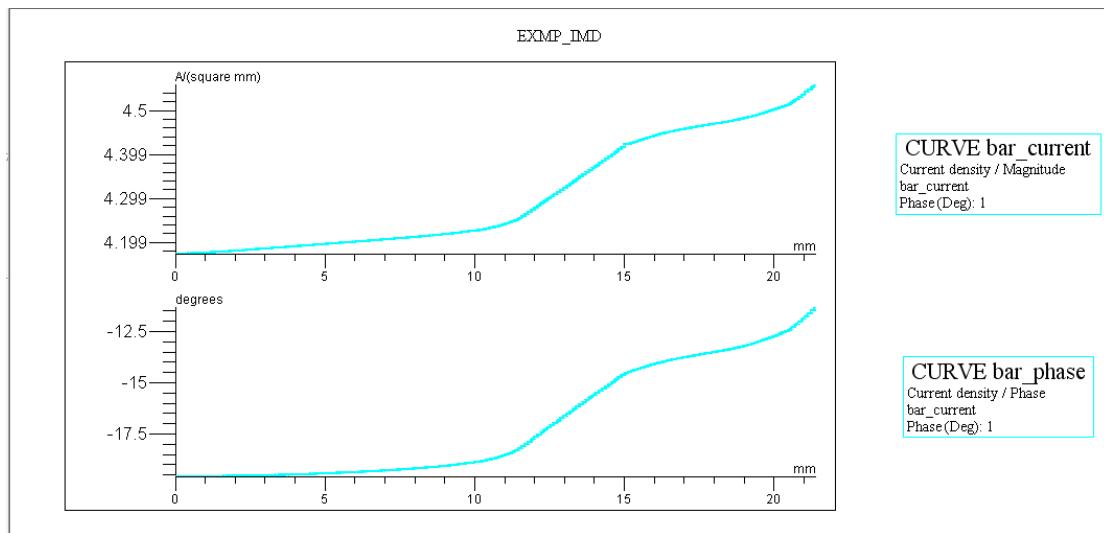


查看磁密径向分量的频谱



12.查看转子槽内的电流分布 建立新的 path manager





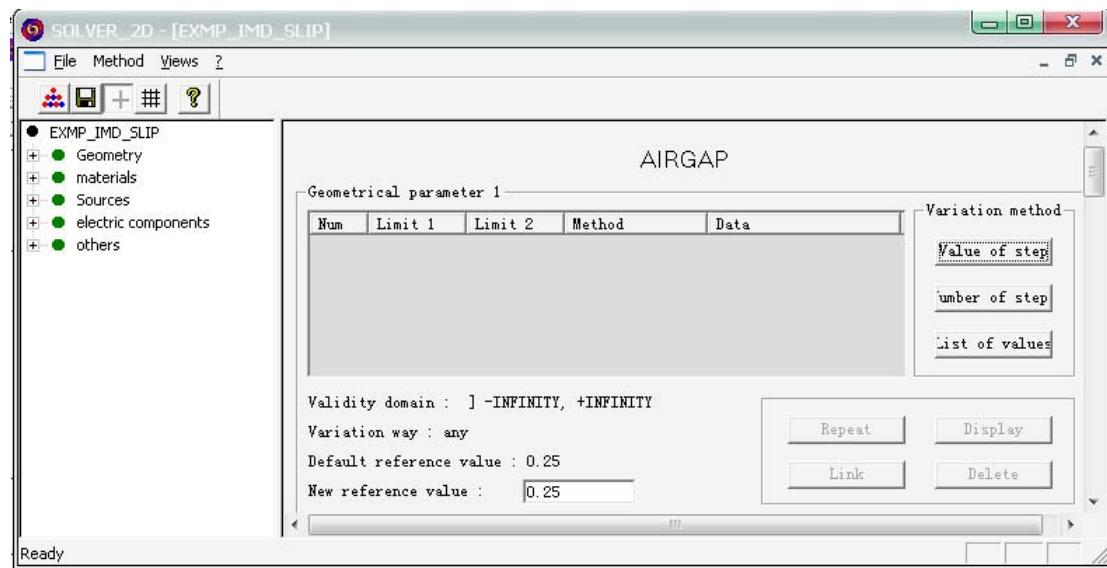
四、参数化求解

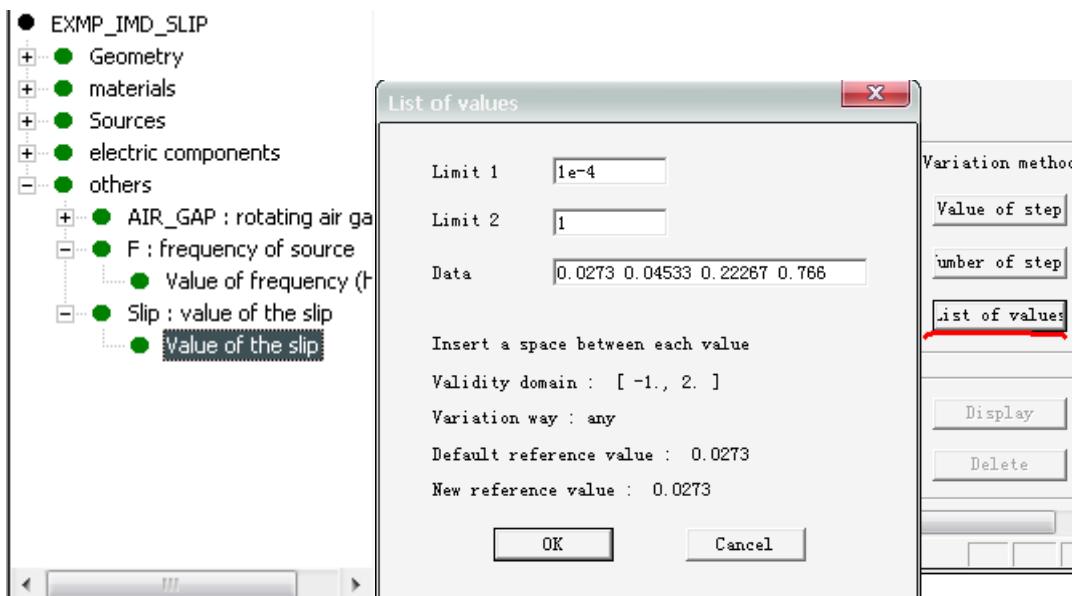
问题描述：通过定义一组数值不同的转差率参数，以仿真电机在不同转速下运行。

1、选取转差率数值

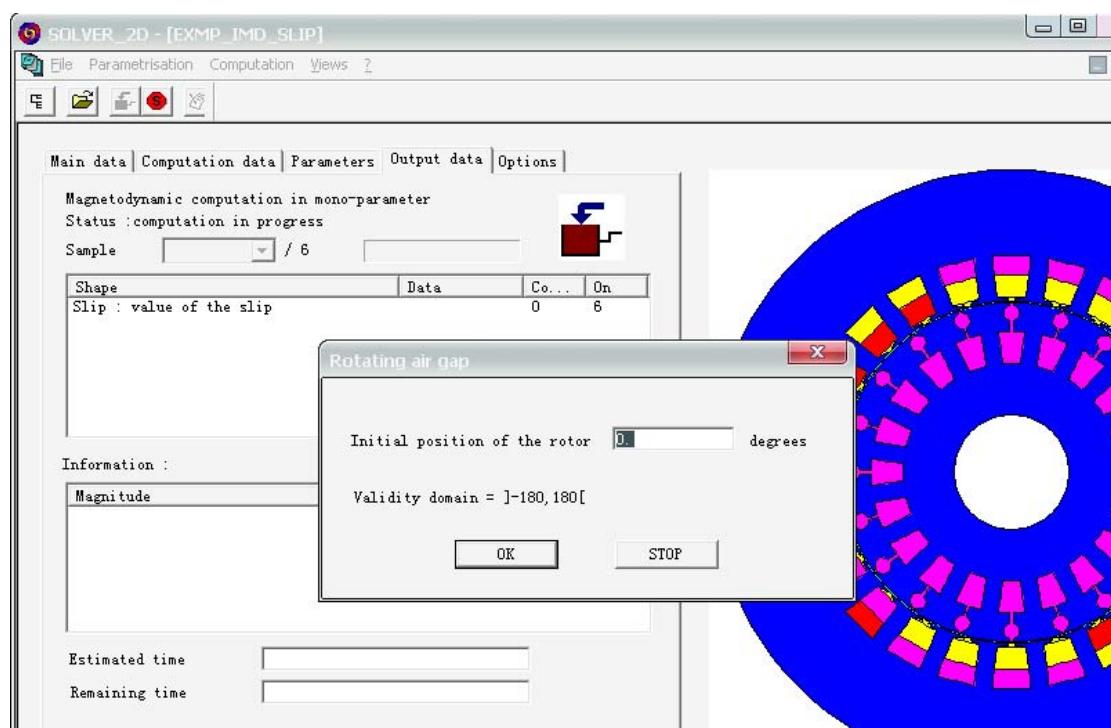
转速	转差率	转差
0	100	1
702	76.6	0.766
2331.9	22.27	0.22267
2864.1	4.53	0.04533
2918.1	2.73	0.02733
3000	0	0.1e-3

2、在 direct 中利用 parameterization tools 设置参数



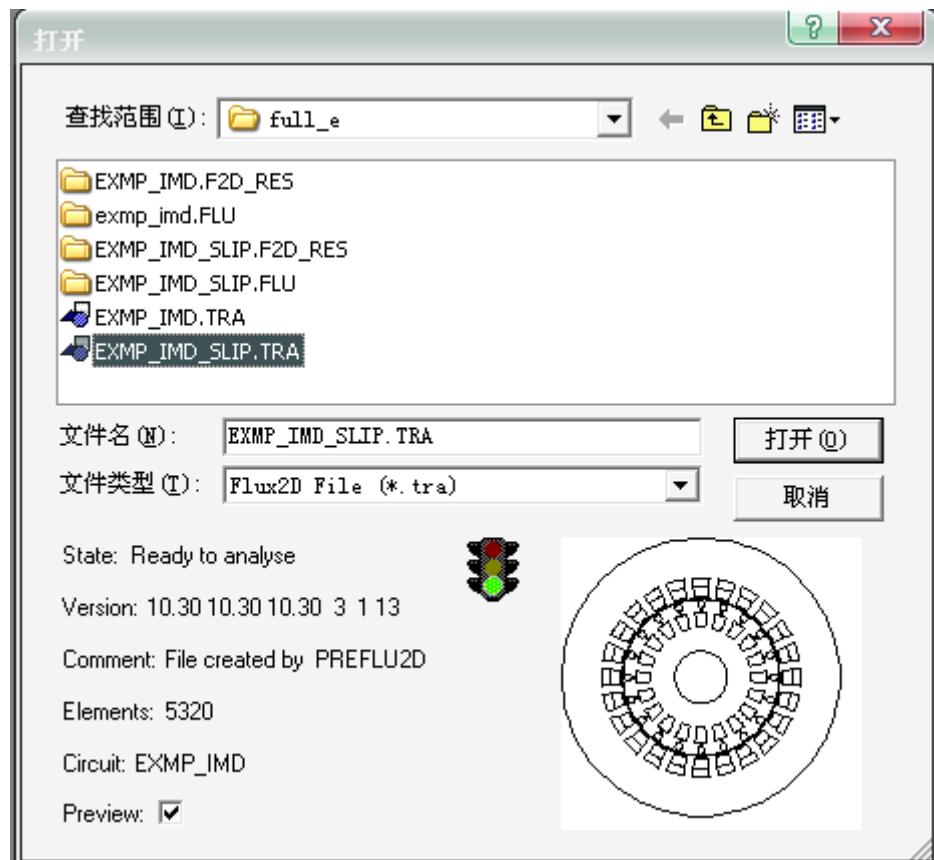


返回 solver -> run the solving process 

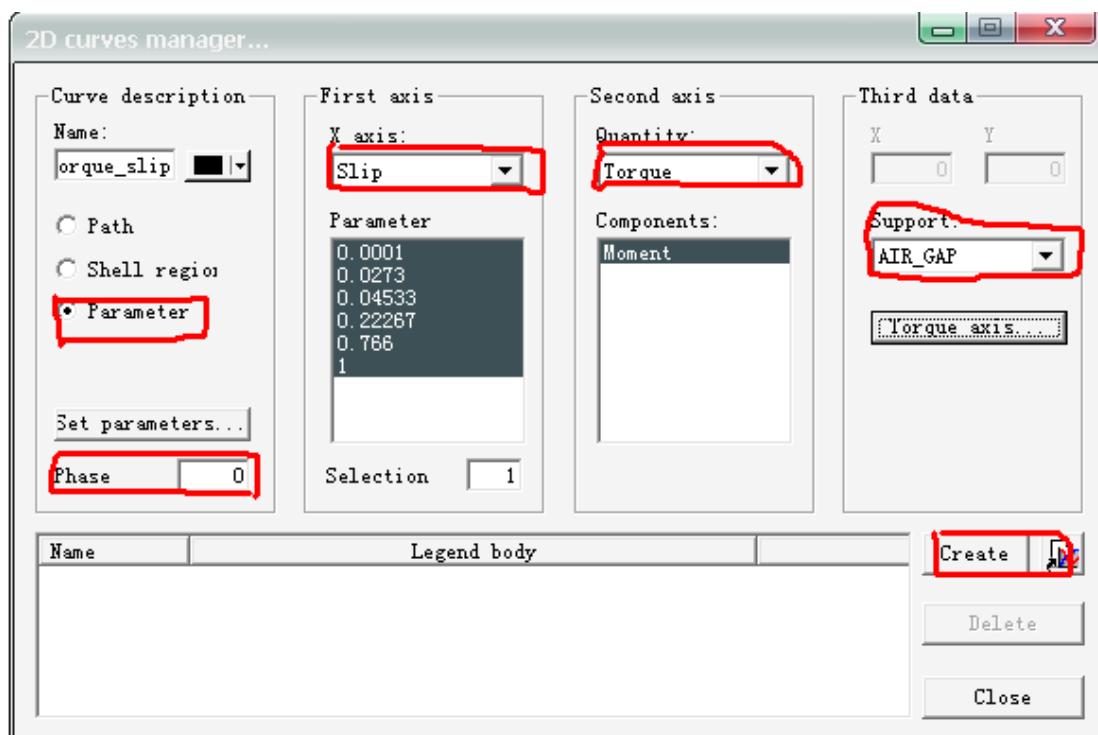


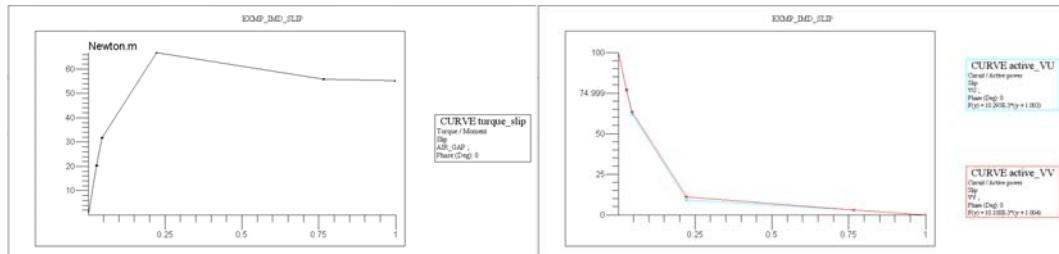
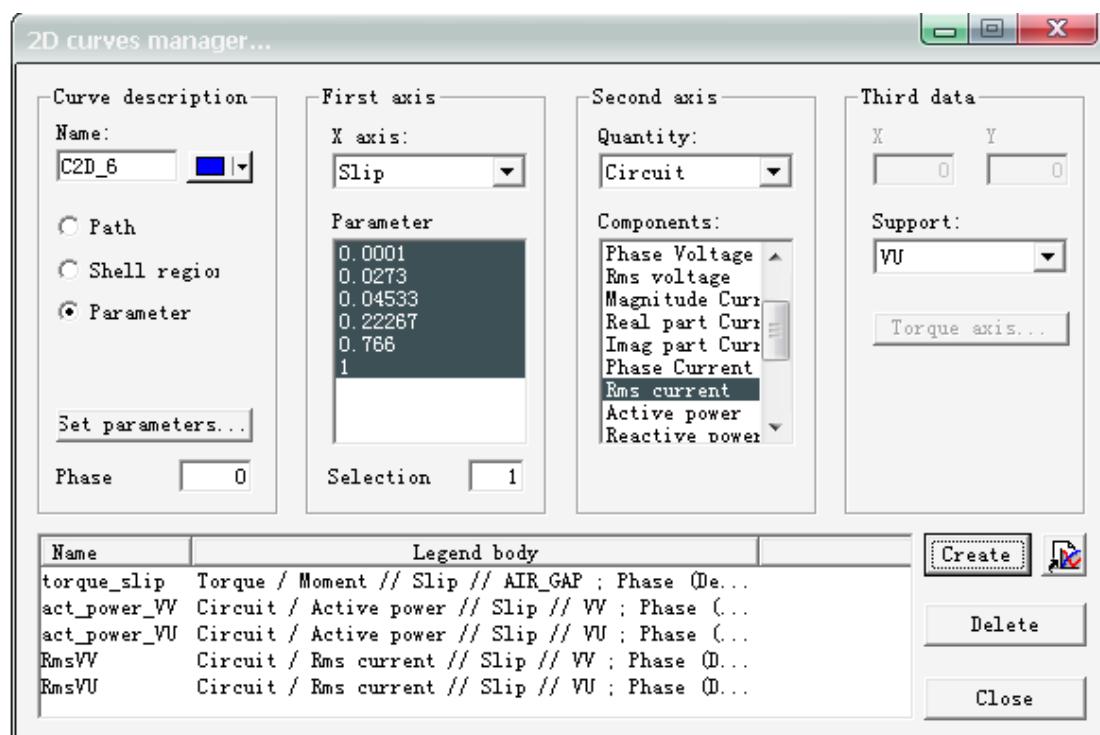
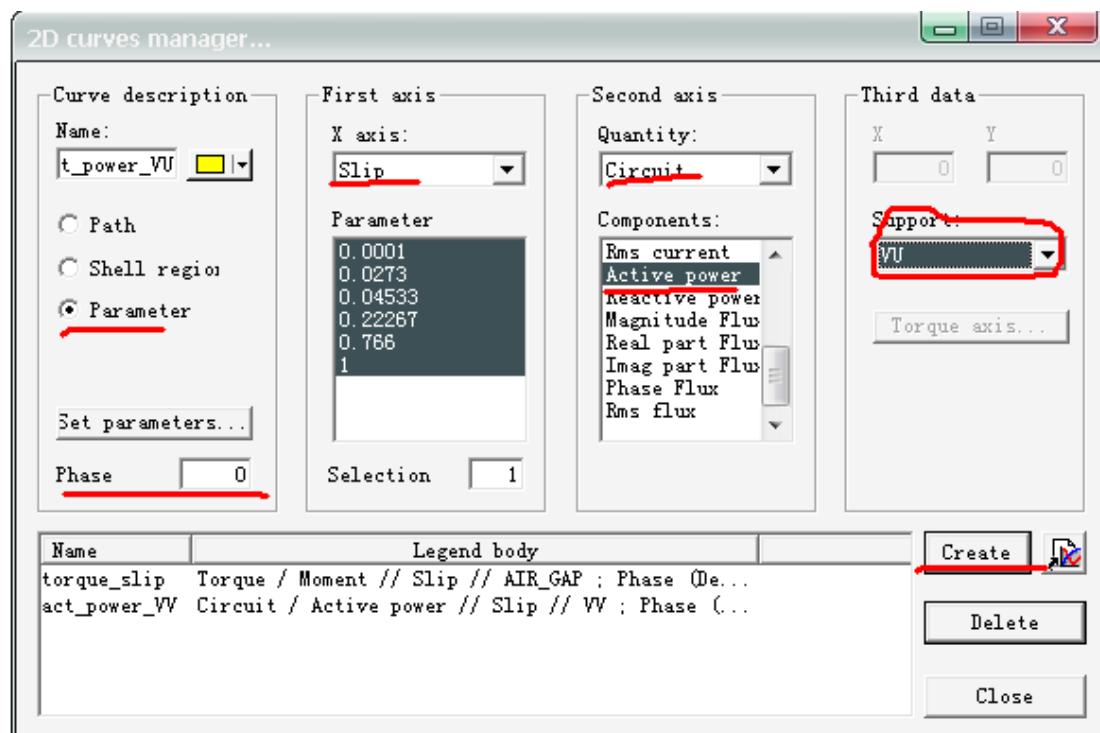
3、查看并分析结果

3.1 在结果中打开文件 Result -> open subject



3.2 查看转矩、电源发出的有功功率、电流随转差率的变化情况







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目前为止，公司的产品涵盖了电子产品散热仿真分析，电磁仿真分析，电力电子仿真分析以及温度/速度测试设备，液冷解决方案等方面。公司长期稳定的发展吸引了大批有丰富经验的博士，硕士的加盟，使得公司在上述这些方面拥有足够的技术实力，能够为客户提供除了仿真软件以外的技术支持和咨询服务，以及完整的解决方案。

北京天源博通科技有限公司

地址: 北京市海淀区复兴路 65 号电信实业大厦 812 室

邮编: 100036

邮箱: info@tianyuantech.com

电话: (+8610) 68221702/21/12/29

传真: (+8610) 68221709

网址: www.tianyuantech.com