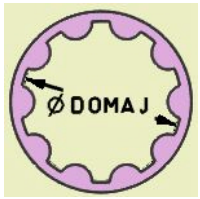
Gerotor Modeling with NX3.

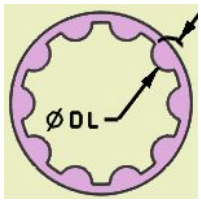
1. Gerotor design parameters.

Following is the list of design parameters of a gerotor gear set. Despite the simplicity of relations between these parameters, this "quick reference" might be useful for the casual gerotor designer since the parameters (and their names) provided are rather "site specific" and s/he might be left wondering what the printout from some proprietary software means.

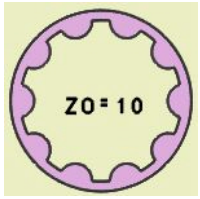
Outer Rotor Major Diameter (DOMAJ):



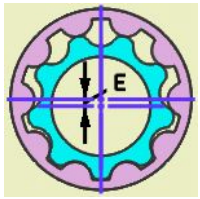
Outer Rotor Lobe Diameter (DL):



Outer Rotor Lobe Number (ZO):



Eccentricity (E):



Inner Rotor Minor Diameter (DIMIN):

DIMIN=DOMAJ-6.0*E

Inner Rotor Major Diameter (DIMAJ):

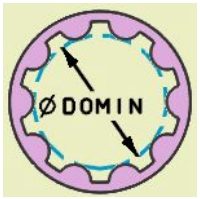
DIMAJ=DOMAJ-2.0*E

Inner Rotor Lobe Number (ZI):

ZI=ZO-1

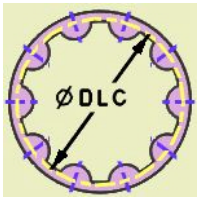
Outer Rotor Minor Diameter (DOMIN):

DOMIN=DOMAJ-4.0*E



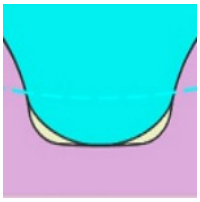
Outer Rotor Lobe Centers Diameter (DLC):

DLC=DOMAJ+DL-4.0*E



2. Outer Rotor Profile Modeling.

The outer rotor profile is made of circular arcs only. There are a few different approaches to the design of the outer rotor lobe root, besides a simple edge blend, so local design guidelines should be consulted.



3. Inner Rotor Profile Modeling with Spline Control Points.

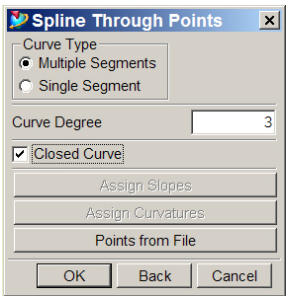
There may be a text file available with inner rotor profile spline control points. This can also be generated using GRPC061220:

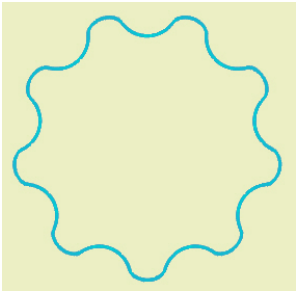
2.2.9. Capacity (QM).....(mm^3/rev): 11800
(QI).....(in^3/rev): 0.72

2.3.1. Inner Rotor Profile Control Point Coordinates:

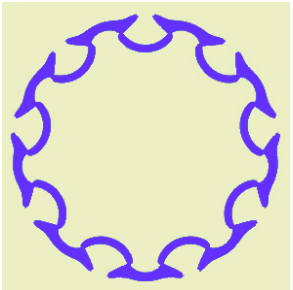
X	Y	Z
34.200000000000000	0.000000000000000	0.0
34.199757100938260	0.054892757516832	0.0
34.199028516055490	0.109774378953089	0.0

Use these points to build a spline approximating inner rotor profile:

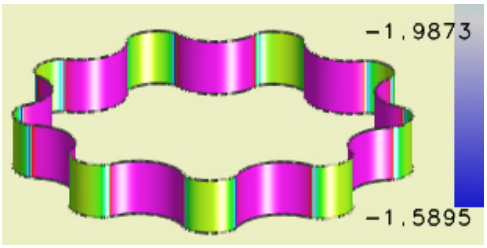




Use curve analysis to detect any abnormalities:

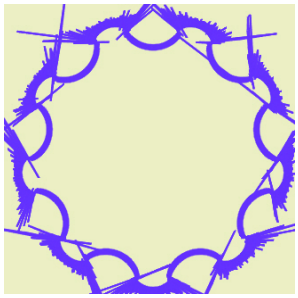


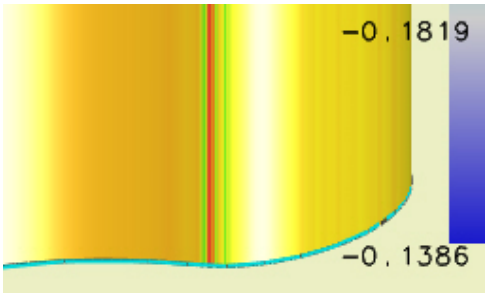
And smooth section geometry, naturally, creates smooth lobe surfaces:



(Note the value of minimum curvature radius).

For this example we used control points generated by gerotor pump calculator GRPC061220. The maximum number of meaningful digits for a mantissa format in NX3 is 15. GRPC061220's output provides at least 16 digits. Less precise control point coordinates are likely to create profile similar to the one shown below:





(Note the entirely meaningless minimum curvature radius).

Believe it or not, it is considered acceptable in automotive industry at least.

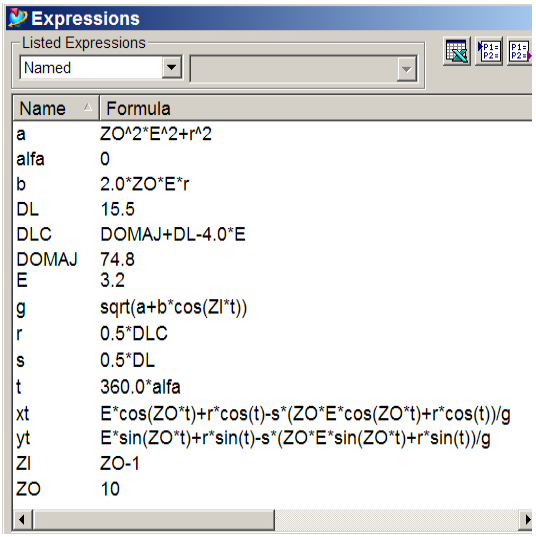
4. Inner Rotor Profile Modeling with NX3 “Expressions”.

The inner rotor profile is defined by the following equations:

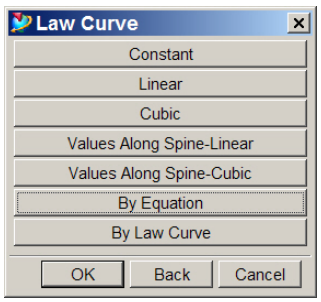
x(t)=E*cos(ZO*t)+r*cos(t)-s*(ZO*E*cos(ZO*t)+r*cos(t))/g
y(t)=E*sin(ZO*t)+r*sin(t)-s*(ZO*E*sin(ZO*t)+r*sin(t))/g

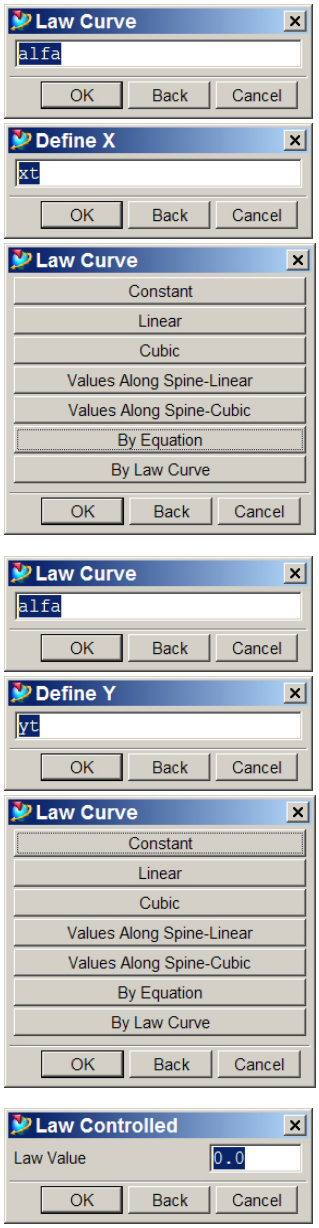
where:
r=0.5*DLC
s=0.5*DL
g=sqrt(a+b*cos(ZI*t))
a=ZO^2*E^2+r^2
b=2.0*ZO*E*r
0.0<=t<2.0*pi

Create expressions to represent the above equations:

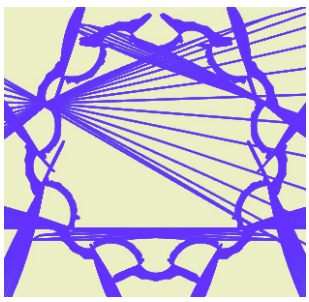


Create a “law curve”:

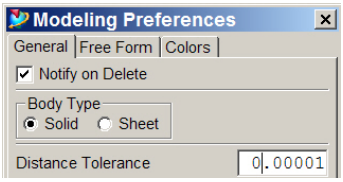


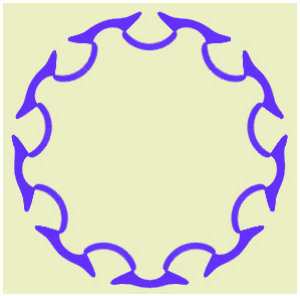


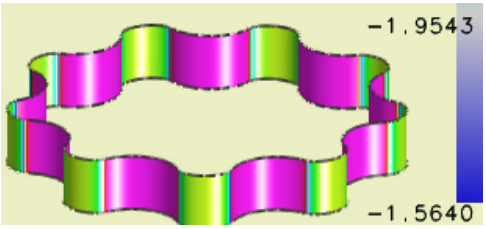
Applying curve analysis, we see that the obtained spline cannot be used to generate a useful profile:



The easy fix for that is to set the "distance tolerance" to its minimum value (0.00001):







The (obvious) advantage to modeling gerotor profiles with "expressions" is parameterized section geometry.