Methods and Tools in Screw compressor design

• **2-D design tools** - Conventional approach
  - SCORPATH (Screw Compressor Rotor Profiling and Thermodynamics)
  - 2-D CAD Software: AutoCad, ...

• **3-D design tools** - More modern approach
  - SCORPATH (Screw Compressor Rotor Profiling and Thermodynamics)
  - 3-D CAD MDT, Inventor, Catia, Solid Works, Pro Engineer
  - SCORG (Screw Compressor Rotor Grid)
  - CCM (CFD) Comet, Star, CFX, Fluent ...

• **3-D design management** - Concurrent approach
  - DISCO (Design Integration for Screw Compressors)
Overview of modern CAD systems

- Integrated Computer Aided Engineering tools
- Incorporate CAD, CAM, and other applications
- User friendly icon based graphical user interfaces
- Based on Variational/ Parametric technology
- Encourage design flexibility and design reuse
- Support Knowledge Based Design
- Allow user applications to be inserted through programmable interface

Philosophy of modern CAD Systems

- A Flexible Modelling environment
  - Ability to easily modify models, and implement design changes
  - Support for data sharing, and data reuse
- Knowledge enabled
  - Capture of design constraints, and design intent as well as final model geometry
  - Management of non-geometric as well as geometric design information
- The 3D Part is the Master Model
  - Drawings, Assemblies and Analyses are associative to the 3D parts. If the part design changes, the downstream models with change too.
Applications usually included in modern CAD

- Product Structure
- Part Design
- Assembly Design
- Sketcher
- Drafting (Interactive and Generative)
- Wireframe and Surface modelling
- Freestyle Shaper
- Digital Shape Editor
- Knowledgeware
- Photo Studio
- 4D Navigator (including kinematics)
- Manufacturing
- Finite Element Analysis
- (CFD – Finite volume)
Mechanical calculation
Bearing selection, bolts, housing thickness …

- Based on forces calculated in either 1D or 3D
- Using bearing life theory

Finite element calculation
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  - **DISCO** (Design Integration for Screw COmpressors)
DISCO Integration

SCOCAD

CAD System

CCM System

SCORG

Structure of DISCO

SCORPATH

Geometry
Thermal
Dynamic

Grid generator
Boundary conditions

CCM Model
COMET Solver
Comsol Postprocessor

ACOUSTIC Model
FEM - ESM conversion
Acoustic boundary conditions
Acoustic calculations

SCORPATH

INPUT

OUTPUT

Geometry
Thermal
Dynamic

SCOCAD

INPUT

OUTPUT

Design
3D model
Drawing

SCORG

INPUT

OUTPUT

Discharge
Source

SCOCAD

INPUT

OUTPUT

param, dat
x, y, z, 0.0
x, y, 0.05

SCOCOM

INPUT

datat.dat

OUTPUT

esm.dat

JOINT
DISCO DISCO

• Connects 4 groups of design software:
  SCORPATH  -  SCORG  -  CAD  -  CCM(CFD)
• Supports concurrent and sustainable design process.
• Integrates software groups parametrically
• Enables entire design cycle, from a conceptual to detailed design, to be conducted in the unique environment
• Automatically manages data files through parameters
• Enables data sharing
• Enables for selection of different CAD & CFD to be used
• Makes CFD (CCM) more automatic
• Generates CAD models & drawings
• Prepares data for manufacturing
• Generates reports
• Enables and encourages further developments