BETA TESTING OF MTI SEAL CODES

Joseph Scharrer
RSR Technologies
North Highlands, California

MTI CODE EVALUATION

INTRODUCTION

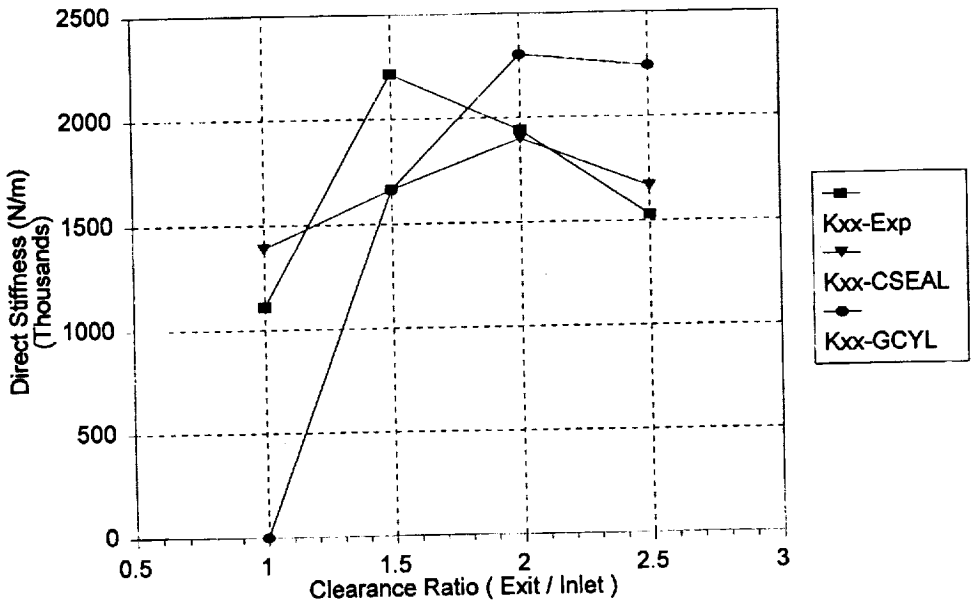
- **Cylindrical Air and Water Seals Compared**
  - **TAMU Tapered Gas Seal**
    - **CSEAL and GCYL compared**
  - **Mitsubishi Eccentric Water Seal**
    - **HSEAL and ICYL compared**

MTI CODE EVALUATION

GCYL Rudiments

- **Unit Conversion Confusing**
  - **Operating Conditions invariably show English Units**
- **Inlet Tangential Velocity not Input Variable**

CSEAL, GCYL Comparison
Test Data From Elrod



CSEAL, GCYL Comparison
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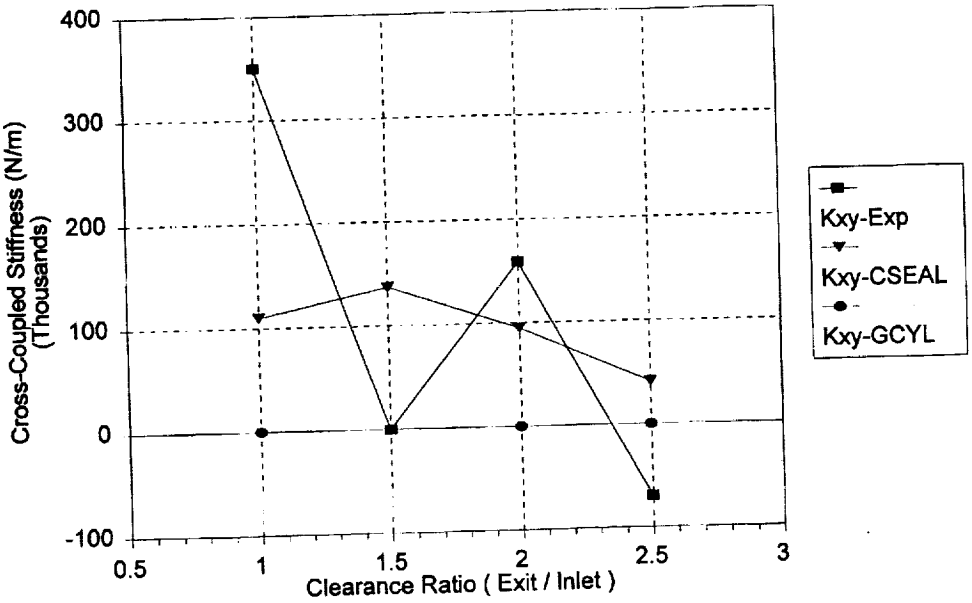
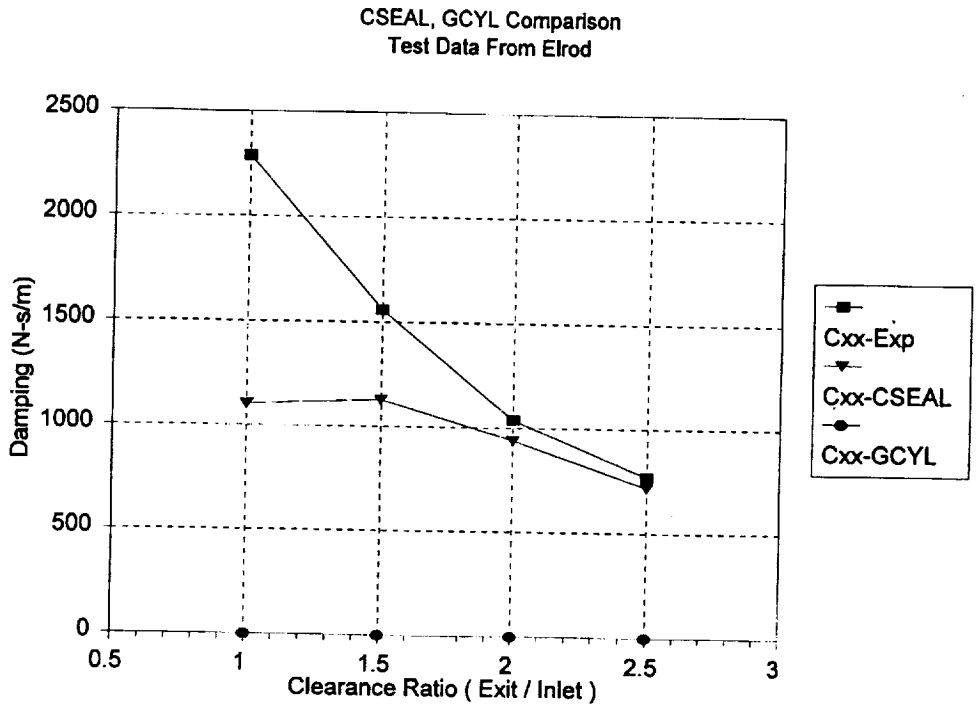




MTI CODE EVALUATION

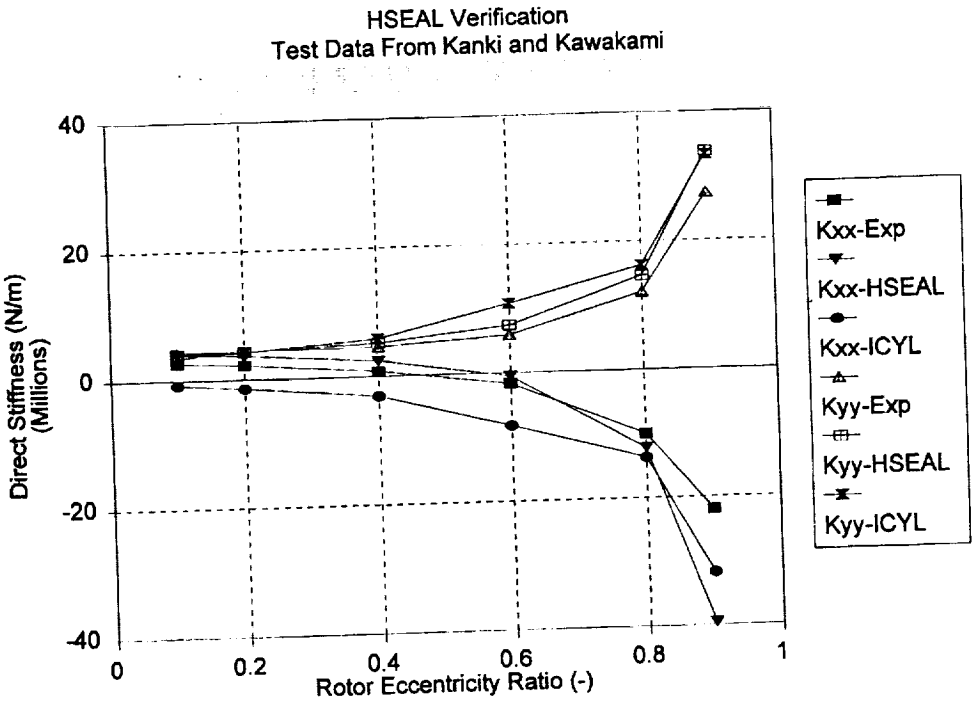
GCYL and CSEAL Results Compared to TAMU Data

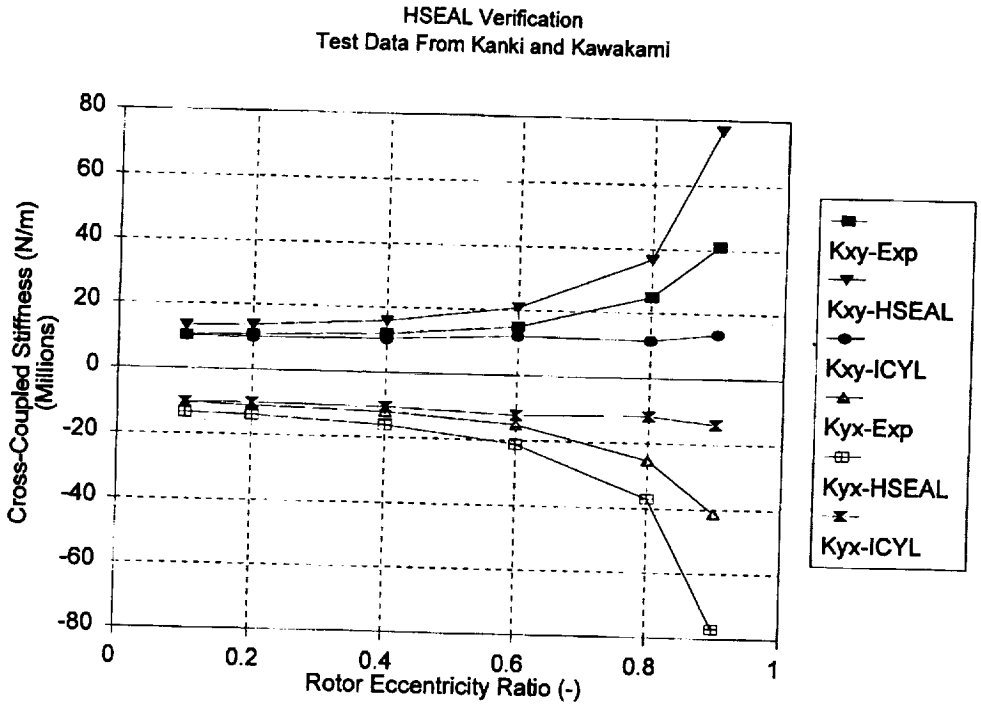
- **Direct Stiffness**
  - **GCYL Comparison Favorable**
  - **CSEAL Closer to experiment at Small and Large Tapers**
- **Cross-Coupled Stiffness**
  - **Neither Code Predicts Trend or Magnitude Well**
  - **GCYL predicts essentially 0**
- **Direct Damping**
  - **CSEAL Predicts trend and Magnitude well**
  - **GCYL Predicts Negligible Damping**
- **Leakage**
  - **GCYL grossly Overpredicts**

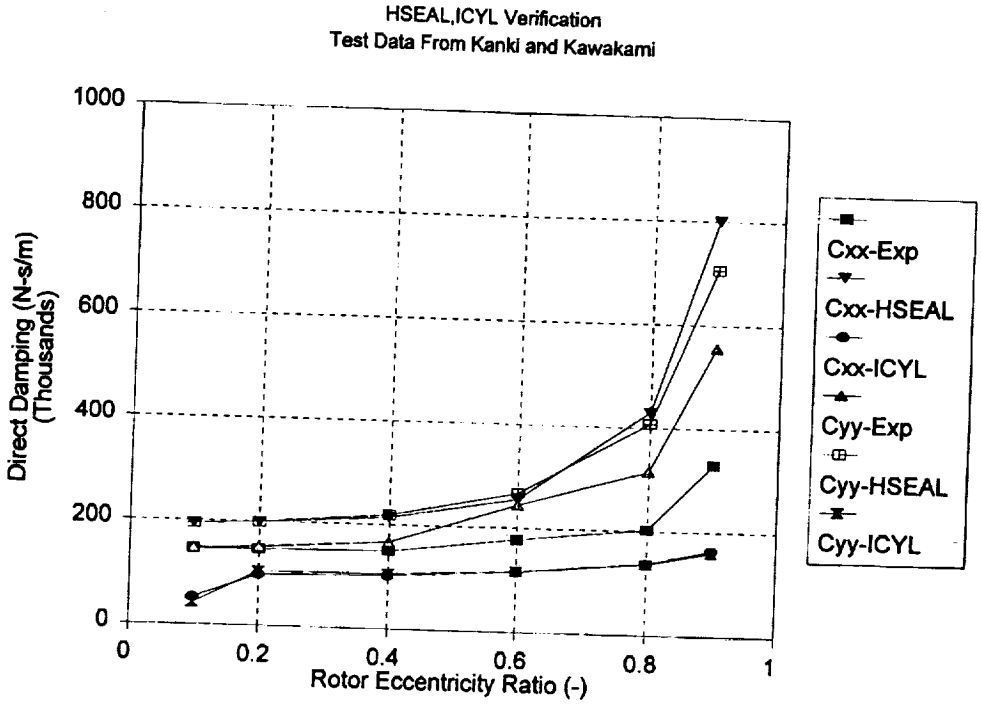
MTI CODE EVALUATION

ICYL Rudiments

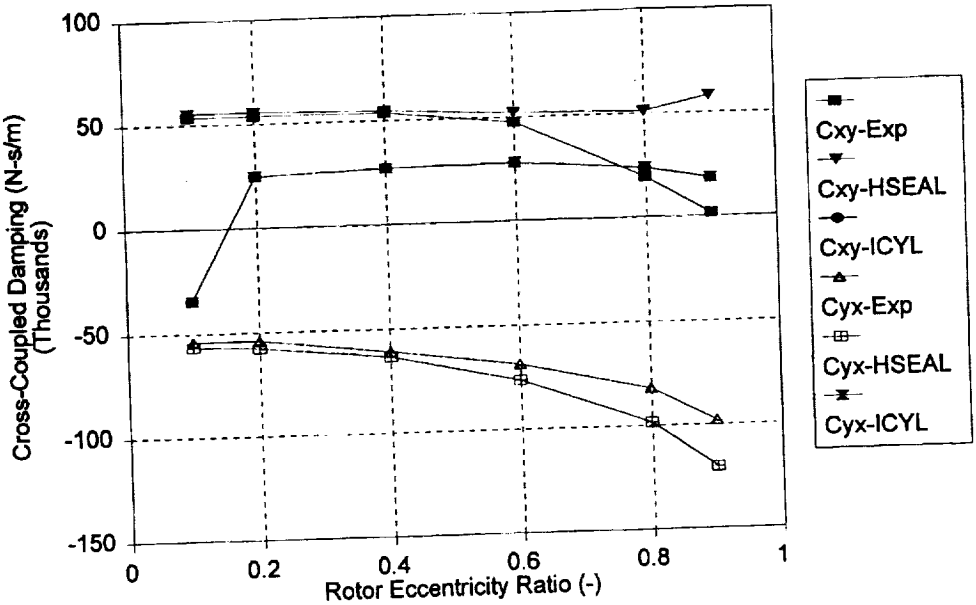
- **Non-Symmetric Coefficients for Zero Eccentricity**
- **Unit Conversion Confusing**
  - **Operating Conditions invariably show English Units**
- **Inlet Tangential Velocity not Input Variable**
- **No Added Mass Coefficients calculated**



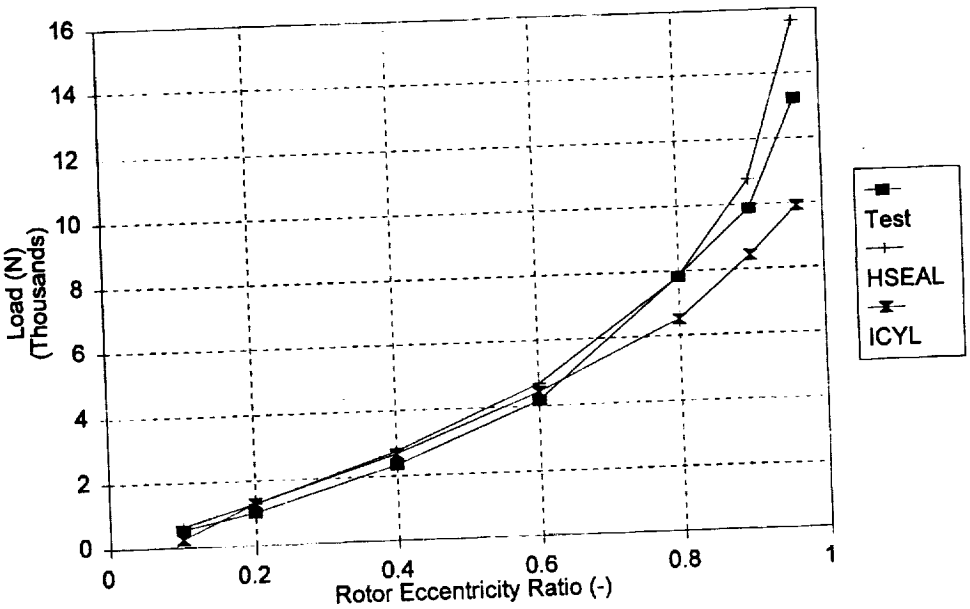

HSEAL Verification
Test Data From Kanki and Kawakami
Cross-Coupled Stiffness (N/m)
(Millions)
80
60
40
20
0
-20
-40
-60
-80
0
0.2
0.4
0.6
0.8
1
Rotor Eccentricity Ratio (-)
Kxy-Exp
Kxy-HSEAL
Kxy-ICYL
Kyx-Exp
Kyx-HSEAL
Kyx-ICYL


HSEAL,ICYL Verification
Test Data From Kanki and Kawakami
Direct Damping (N-s/m)
(Thousands)
1000
800
600
400
200
0
0
0.2
0.4
0.6
0.8
1
Rotor Eccentricity Ratio (-)
Cxx-Exp
Cxx-HSEAL
Cxx-ICYL
Cyy-Exp
Cyy-HSEAL
Cyy-ICYL

HSEAL Verification
Test Data From Kanki and Kawakami



HSEAL Verification
Test Data From Kanki and Kawakami



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MTI CODE EVALUATION

ICYL and HSEAL Results Compared to Mitsubishi Data

- **Direct Stiffness**
  - **ICYL and HSEAL Comparison Favorable**
  - **Both Codes Overpredict**
- **Cross-Coupled Stiffness**
  - **Neither Code Predicts Magnitude Well**
  - **ICYL Underpredicts Magnitude**
  - **HSEAL Overpredicts Magnitude**
- **Direct Damping**
  - **HSEAL Overpredicts Magnitude**
  - **ICYL Underpredicts Magnitude Significantly**

(continued)

MTI CODE EVALUATION

ICYL and HSEAL Results Compared to Kanki Data - continued

- **Cross-Coupled Damping**
  - **HSEAL predicts Magnitude and Trend well**
  - **ICYL misses negative values at large eccentricities**
- **Loads**
  - **ICYL and HSEAL predict loads well**
  - **HSEAL better principally for Long Seal**

MTI CODE EVALUATION

SUMMARY

- ICYL and GCYL Geometry Variations Desirable
- Load and Direct Stiffness Calculations Good
- Damping and Cross-Coupled Stiffness Predictions Poor
- Added Mass Coefficients should be Calculated
- Variation in Inlet Tangential Velocity Critical to Design