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A Better Measure.

Determining Spring Constant

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INTRO:

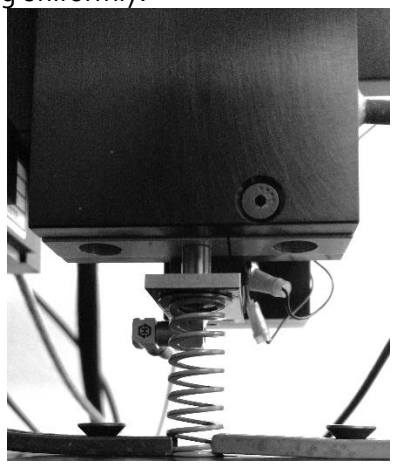
A spring's ability to store mechanical energy has a long history of use. From bows for hunting, door locks, or clocks, the technology has been around for many centuries. In modern times, springs still see many uses in automotive, jewelry, household appliances, and other industries. With large variety of uses, it is important to differentiate springs based on their mechanical properties.

DETERMING SPRING CONSTANT WITH NANOVEA'S MECHANICAL TESTER

One important mechanical property of springs is their ability to compress or stretch when a load is applied. This is described with by the spring constant. The spring constant (k) can be found by looking at the slope of the load vs. depth curve; a linear spring will follow Hooke's Law: $F = -kx$. The Nanovea's Mechanical Tester can precisely record the changes in depth as it applies a load onto the spring. With the different modules on the Nanovea's Mechanical Tester, loads ranging from sub mN to 200N can be applied onto a spring. Spring deflection exceeding 3mm be recorded as well. As the spring constant increases, more load will be necessary to accurately obtain the spring constant.

MEASUREMENT OBJECTIVE

Three coil springs were tested with Nanovea's Mechanical Tester's Nano Module. Each spring was mounted in a fashion to eliminate non-vertical compression. A large flat indenter was used to apply the load onto the spring uniformly.



TEST CONDITIONS & PROCEDURES

The following indentation parameters were used:

	All Samples
Maximum Force (mN)	150
Loading Rate (mN/min)	300
Unloading Rate (mN/min)	300
Creep (s)	N/A
Indenter Type	Flat
Indenter Radius (mm)	12.7

RESULTS:

Below are graphs displaying the data for the three springs samples. A linear line was fitted onto the curve to obtain the slope of the loading curve. The R^2 value describes how well the linear line was fitted to the dataset (1 being a perfect fit).

Table 1: Spring Constants for Tested Springs

Spring #	Spring Constant
1	0.9351
2	1.5219
3	2.2397

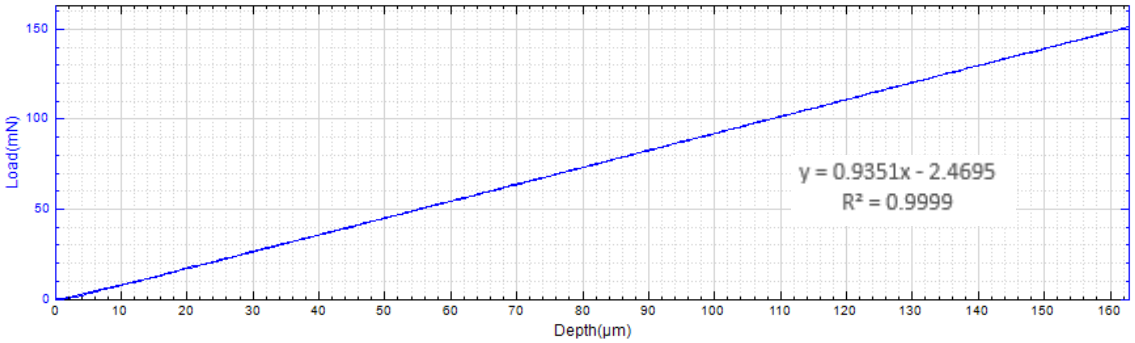


Figure 1: Load vs Depth for Spring 1

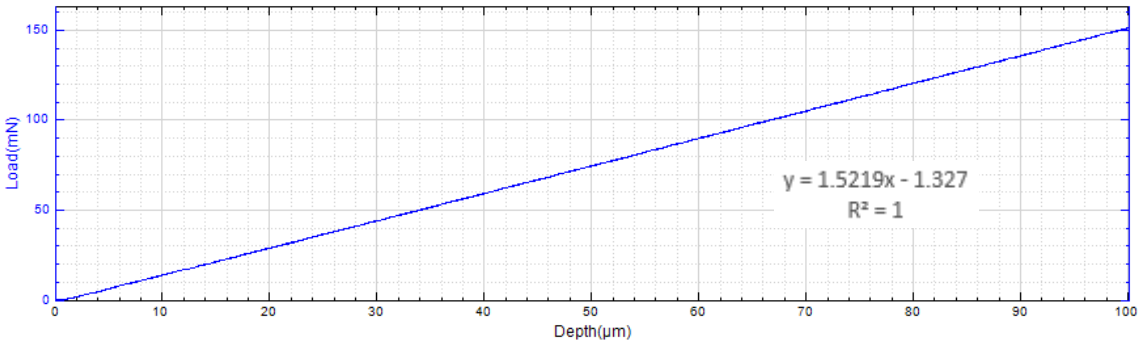


Figure 2: Load vs Depth for Spring 2

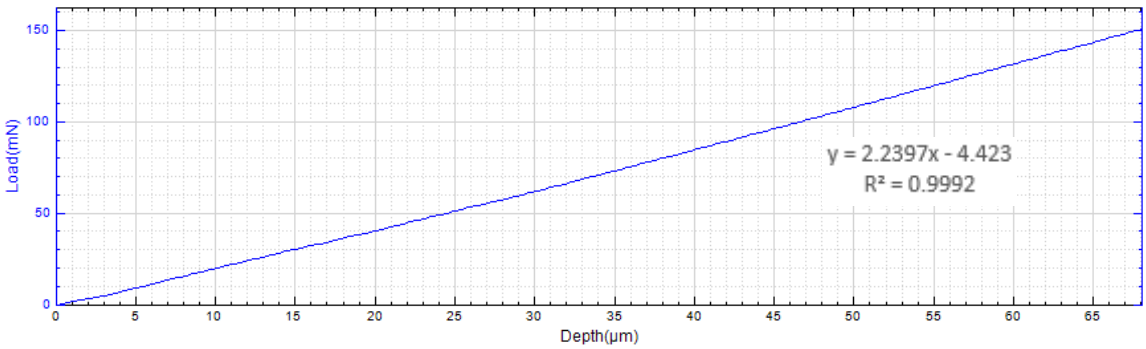


Figure 3: Load vs Depth for Spring 3

CONCLUSION:

The spring constant for three different springs were investigated with Nanovea's Mechanical Tester Nano Module. With its ability to precisely record depth and load, a load of 150mN was applied onto the spring and its deflection was measured. The spring constant was found by applying a linear fit to the load vs. depth curve. The spring constants found were 0.9351, 1.5219, 2.2397. Testing with higher loads and recording its change in depth (up to more than 3mm) can be done with Nanovea's Mechanical Tester's Micro/Macro Module as well.