# Scientific achievements

## 1. Thesis

**Silicone rubbers belong two typical groups depending on their tension test characteristic. One group's characteristic approximates a concave courve and another one has one inflection point. (Fig. 1.)**

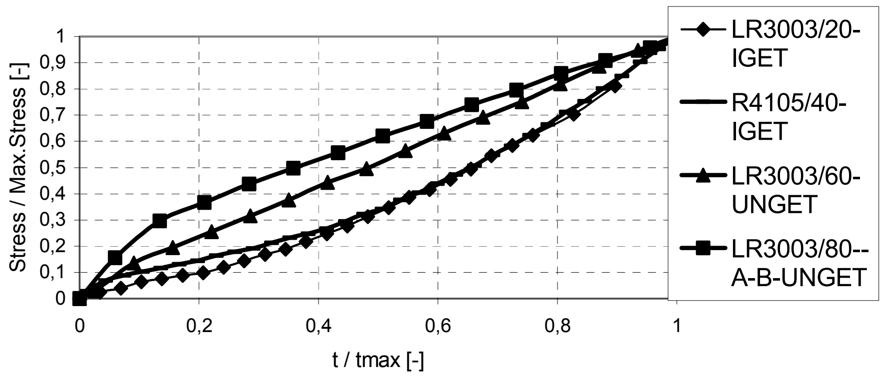


**Fig. 1.** Normalised tension test curves of main hardness classes of silicone rubbers

## 2. Thesis

**There was a general dynamical model of silicone rubbers created using the synthesis method. (Fig. 2.)**

The synthesis method uses the transfer function to get possible impedance/admittance network; however common method in the reology is "trial and error". The measured answer function was used to obtain the transfer function.

The general dynamical model of silicone rubbers equivalents with that special type of Standard-Solid model which has two parallel connected Maxwell model.

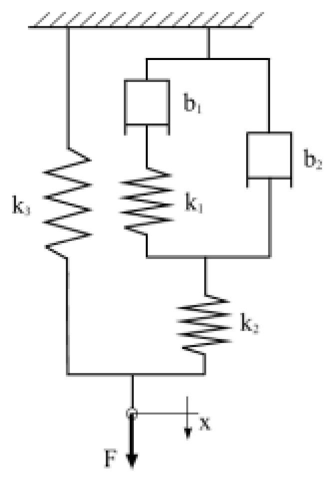


**Fig. 2.**

**2.1. Dynamical model of silicone rubber with concave tension test characteristic is described by the Standard-Solid model.**

## 3. Thesis

**I verified that anisotropic material structures can be made on silicon matrix applying UV radiation.**

Effect of internal process in silicone rubbers was measured on changing of braking strength and breaking elongation strain. According to results we can declare that UV radiation occurs significant changing in material behaviour of silicone rubbers without damaging.

## 4. Thesis

**I determined the hydraulic capacity of varying volume cylindrical and spherical tanks made of silicone rubber and checked the analytical results by measurements.**

Hydraulic capacity of spherical tank is:

$$C_h^{gömb}(V) = \frac{0.5\cdot V\cdot\left(0.5\cdot h - R_0 + 0.620\cdot\sqrt[3]{V}\right)}{h\cdot C_{01}\cdot\left(-3+\frac{8\cdot R_0^2}{\left(h+\sqrt[3]{\frac{6\cdot V}{\pi}}\right)^2}+\frac{\left(h+\sqrt[3]{\frac{6\cdot V}{\pi}}\right)^4}{16\cdot R_0^4}\right)+h\cdot R_0\cdot C_{10}\cdot\left(-3+\frac{h^2}{2\cdot R_0^2}+\frac{16\cdot R_0^4}{\left(h+\sqrt[3]{\frac{6\cdot V}{\pi}}\right)^4}+\frac{1.2407\cdot h\cdot\sqrt[3]{V}+0.769\sqrt[3]{V^2}}{R_0^2}\right)}$$

where $V$ : momentary volume; $h$ : shell thickness; $R_0$ : medium radius of sphere; $C_{10}$, $C_{01}$ : material constants according to Mooney-Rivlin theory.

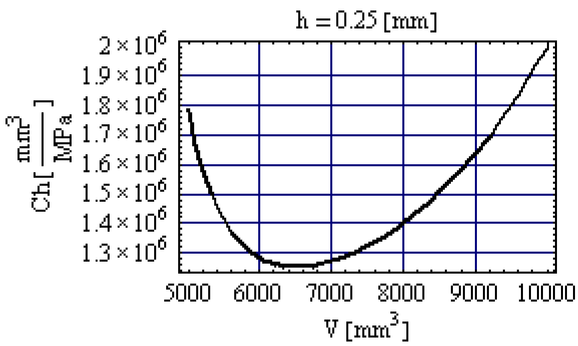


**Fig. 3.** Hydraulic capacity of spherical tank $h = 0.25$ [mm] wall thickness, $V_0 = 4188$ [mm$^3$] initial volume

If the capacity depends explicit only on the volume $C_h(V)$ we obtain next expression for the physical equation of hydraulic capacity:

$$q_V = \frac{C_h \cdot \frac{dp}{dt}}{1 - \frac{dC_h}{dV} \cdot p},$$

where $q_V$ :volume flow, p: overpressure.

## 5. Thesis

**Torus implantation to handle incontinence problem with geometrical data of $a = 9$ [mm], $R = 4$ [mm] stay in stable state during operation if its shell thickness is larger than 0.25 [mm].**

where **a** : distance between meridian curve centre and rotational axis;

**R** : radius of meridian curve.

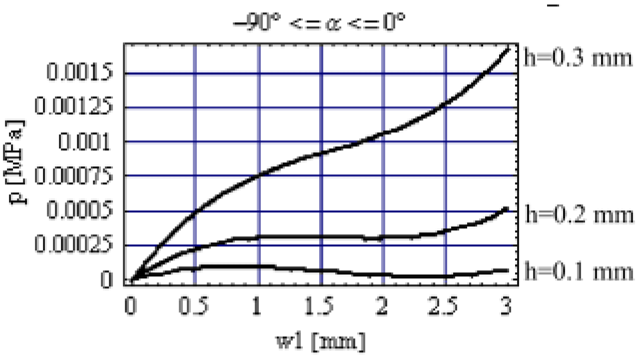


**Fig. 4.** Characteristic of meridian curve part of 90° <= α <= 0° depending on shell thickness

where

$$\alpha = \text{Arcsin}\frac{r - a}{R}.$$

## 6. Thesis

**I have developed flexible medical diagnostic sonde made of silicone rubber whose locomobile ability was realised by longitudinal travelling-wave. (Fig. 5.)**

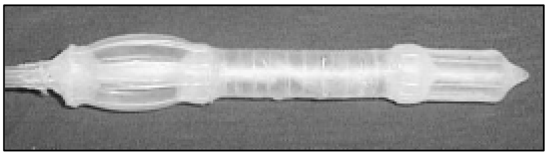

**Fig. 5.** Locomobile silicone sonde

Anisotropic behaviour of tanks of the silicone sonde was carried out by reinforcing.

The longitudinal travelling-wave was worked out by periodical pressing of three independent chambers of sonde.