1

9.4. Snímače zrýchlenia

$$\mathbf{a} = \lim_{\Delta t \to 0} \frac{\Delta \mathbf{v}}{\Delta t} = \frac{d\mathbf{v}}{dt}$$

SI jednotka je **m/s²**

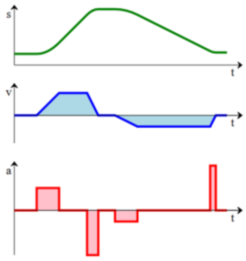
$$F = m \cdot a$$

$$F = k \cdot \Delta x$$

$$a = \frac{k}{m} \Delta x$$

$$a_g = \varkappa \frac{M}{R^2}$$

9,764 – 9,834 m/s²



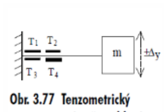
Zdola nahor:
časový priebeh zrýchlenia *a(t)*, integrál zrýchlenia je rýchlosť *v(t)*, a integrovaním rýchlosti získame priebeh dráhy *s(t)*.

2

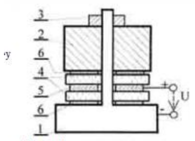
9.4. Snímače zrýchlenia

- Zrýchlenie *a* = *dv / dt*
- Newtonov zákon *F = m.a*

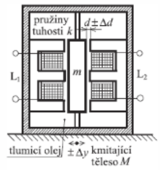
Pri známej hmotnosti telesa *m* je sila *F* merítkom zrýchlenia *a*.



Obr. 3.77 Tenzometrický snímač zrychlení



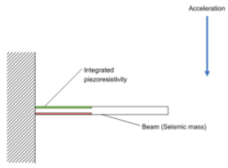
Obr. 3.78b Piezoelektrický tlakový snímač zrychlení



Obr. 3.79 Indukčnostní snímač zrychlení

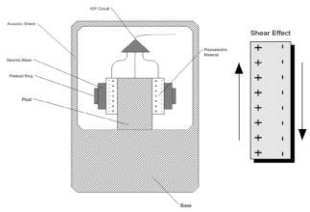
3

9.4. Snímače zrýchlenia
– akcelerometre



Piezorezistívne

Piezoelektrické

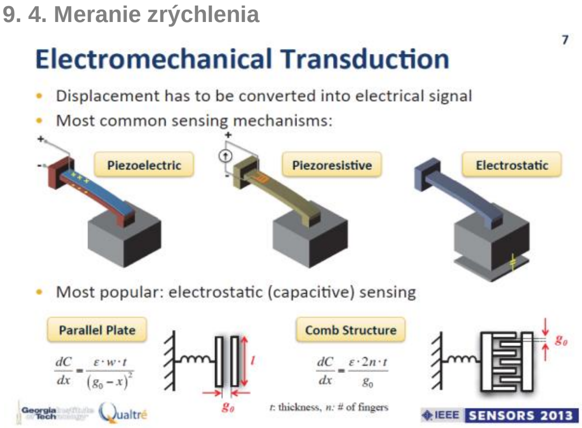


4

9. 4. Meranie zrýchlenia

5

9. 4. Meranie zrýchlenia

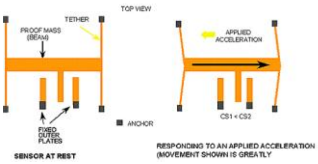


6

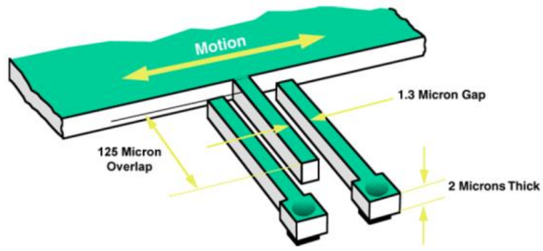
MEMS akcelerometer

ADXL202: ±2 g Dual Axis Accelerometer

Features
- X and Y Axis on a single chip = Small size and lower cost
- 250uA per Axis = Low power battery operation
- 3.0V to 5.0V Operation = Low power battery operation
- Surface mount package = Small size and ease of use
- High resolution PWM converter = Direct interface to micro (No A/D)
- iMEMS = Low cost AND high performance

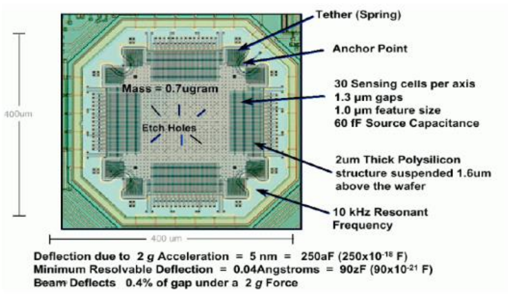


MEMS akcelerometer



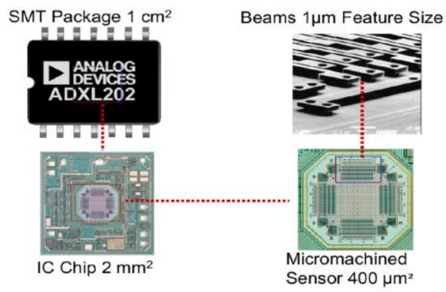
MEMS akcelerometer

ADXL 202: Micromachined Beam

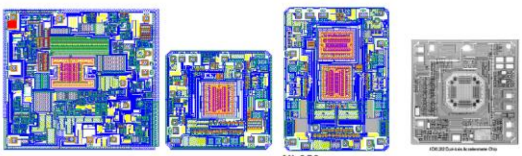


MEMS akcelerometer

ADXL 202: acceleration sensor



MEMS akcelerometer

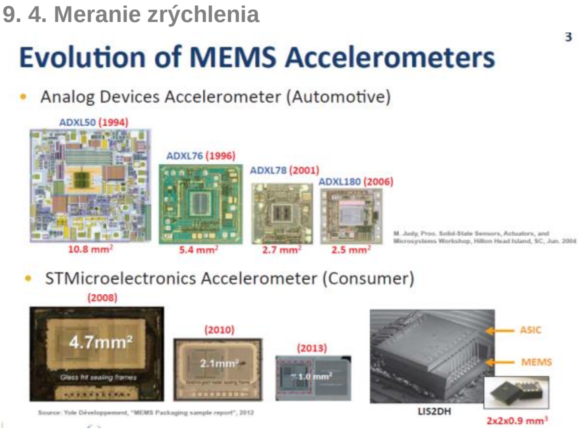


XL50
First Airbag Sensor
50g Analog Output
1993 Saab

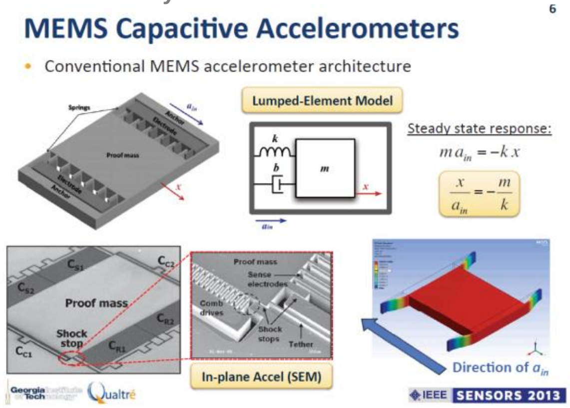
XL150
2nd Gen Airbag
50g Analog Out

XL250
2nd Gen Airbag
2 Axis 50g Analog out
Side Impact

XL202
2 Axis 2g
Digital Output
1.2X XL150



9. 4. Meranie zrýchlenia



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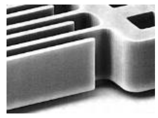
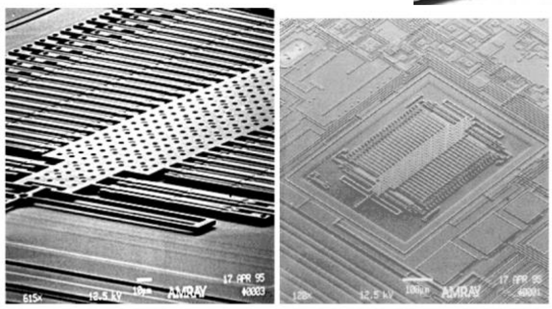
9. 4. Meranie zrýchlenia

MEMS akcelerometer





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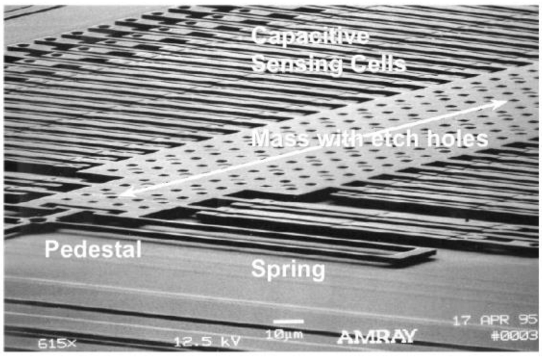
9. 4. Meranie zrýchlenia

MEMS akcelerometer



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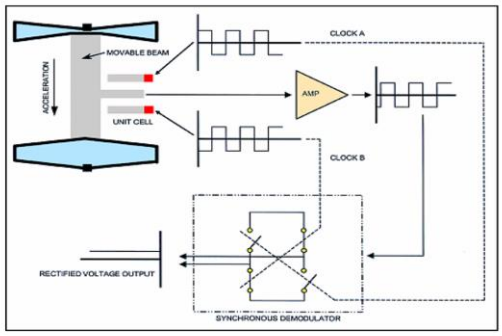
9. 4. Meranie zrýchlenia

MEMS akcelerometer



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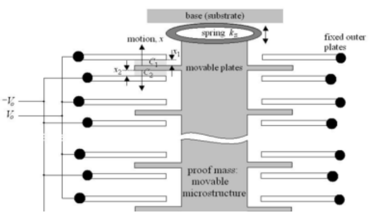
9. 4. Meranie zrýchlenia

MEMS akcelerometer

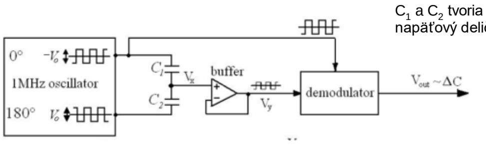


$$C_1 = \epsilon_A \frac{1}{x_1} = \epsilon_A \frac{1}{d+x} = C_0 - \Delta C,$$

$C_1 = C_{11} \parallel C_{12} \parallel \dots \parallel C_{1n}$

$$x \approx \frac{d^2}{\epsilon_A} \Delta C = d \frac{\Delta C}{C_0}$$

C_1 a C_2 tvoria impedančný napäťový delič



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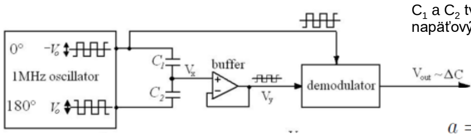
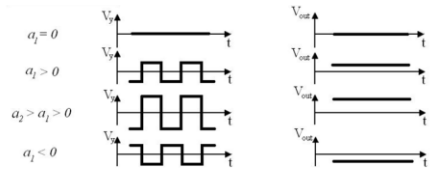
9. 4. Meranie zrýchlenia

MEMS akcelerometer

C_1 a C_2 tvoria impedančný napäťový delič



$$a = \frac{k_S d}{m V_0} V_x.$$



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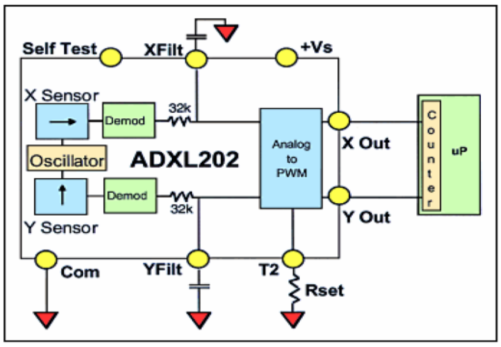
9. 4. Meranie zrýchlenia

MEMS akcelerometer



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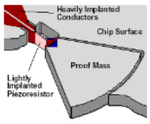
9. 4. Meranie zrýchlenia

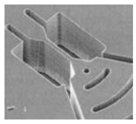
MEMS akcelerometer

•Piezoresistive MEMS accelerometer

–Operating Principle: a proof mass attached to a silicon housing through a short flexural element. The implantation of a piezoresistive material on the upper surface of the flexural element. The strain experienced by a piezoresistive material causes a position change of its internal atoms, resulting in the change of its electrical resistance

–low-noise property at high frequencies





Courtesy of JP Lynch, U Mich.

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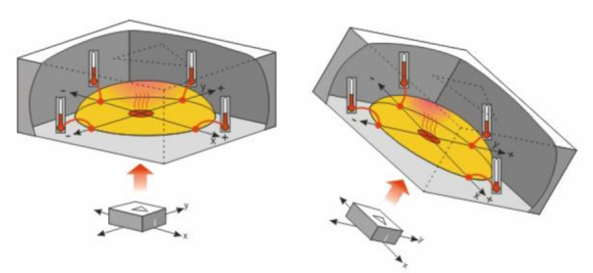
9. 4. Meranie zrýchlenia

MEMS MX2125 hot bubble



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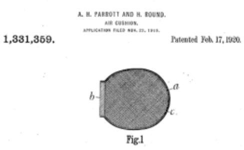
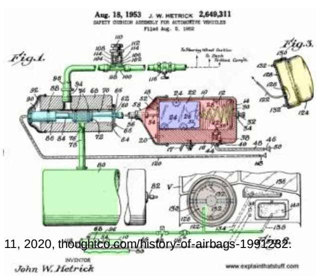
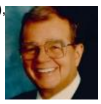


United States patent submitted in 1919 by two dentists, **Harold Round** & **Arthur Parrott** of Birmingham, England

John Hetrick's original airbag design from 1953



Allen K. Breed (1927–2000), who developed a variety of different ways of triggering the explosion of gas inside an airbag just before the impact of a crash.



Bellis, Mary. "The History of Airbags." ThoughtCo, Feb. 11, 2020, thoughtco.com/history-of-airbags-1991232.

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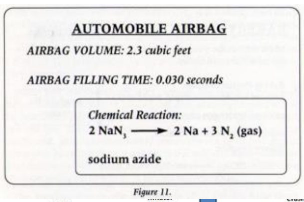
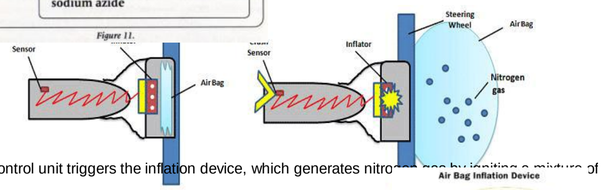
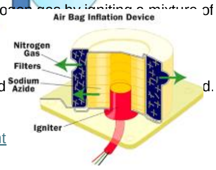


Gas-Generator Reaction	Reactants	Products
First Reaction (Triggered by Sensor)	NaN_3	Na N_2 (g)
Second Reaction.	Na KNO_3	K_2O Na_2O N_2 (g)
Final Reaction.	K_2O Na_2O SiO_2	alkaline silicate (glass)



This control unit triggers the inflation device, which generates nitro... of



Most systems use a weight sensor in the front passenger seat to d... d.

https://cecas.clemson.edu/cvel/auto/systems/airbag_deployment
http://allaboutairbagdeployment.weebly.com/part-three.html

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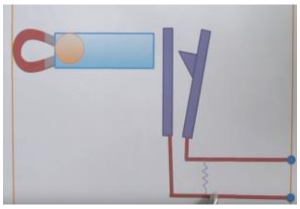
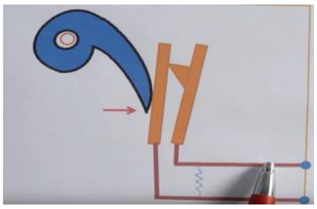
Mechanické





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Mechanické

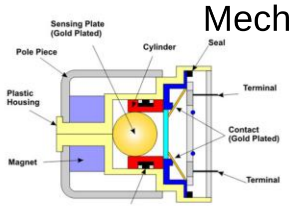

Figure 1. Structural components to an Inert

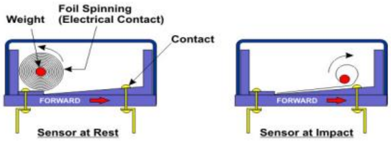

Figure 2. Functional principle to a typical roller type airbag sensor. Source: Erjavec, J. (2010). Au

https://www.azosensors.com/article.aspx?ArticleID=40

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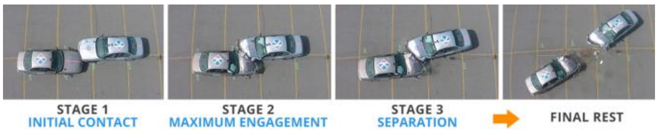
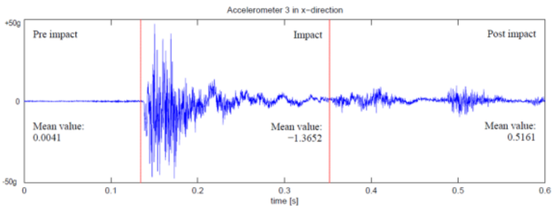


the airbag deployment decision depends upon acceleration and jerk



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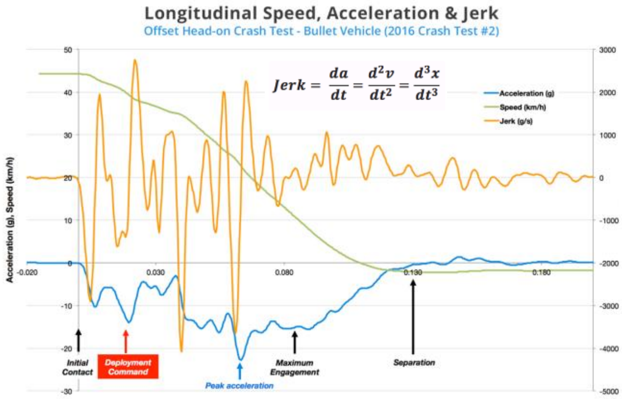
Airbagy – deploy or not deploy?



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