Fakulta strojní VŠB – TUO

Department of Control Systems and Instrumentation

Automatic Control Devices (notes)

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Lecture No. 1

Overview of the principles of sensors and sensors, methods of evaluation, static, dynamic properties (follow-up to the subjects Automation technology, Measurement and sensor technology). (Question 2, 3, 4, 5, 6, 7).

2

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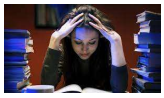
What do you find out?

- An overview of the principles of sensors and sensors
  - Position
  - Distance
  - Temperature
  - Vibration
  - Force
  - ….
- Ways of evaluation
- Static properties
- Dynamic properties
- … .

3

Prerequisite knowledge

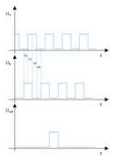
- **In the subjects Automation technology in the bachelor's study –**



- **In the subject Measurement and sensor technology in the master's study… .**

Criterion I

- for measuring electrical quantities,
- …



Criterion I - according to the measured quantity

This is one of the basic criteria used by the

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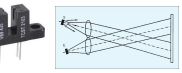
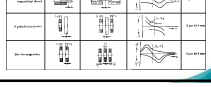
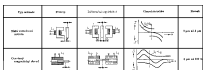
Criterion II

- Capacitive

… .







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Criterion II

Not all methods of evaluation may be

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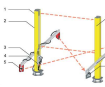
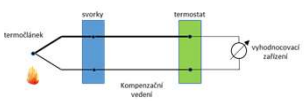
Criterion III -





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Criterion III

The essence of this criterion is whether the given sensor **needs an external …**

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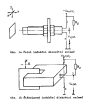
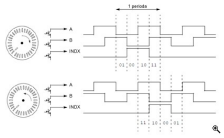
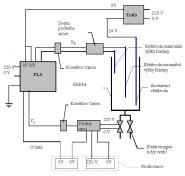
Criterion IV –







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Criterion IV –

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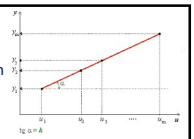
Static properties

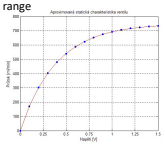
- **Static characteristic**



$$\sigma_{TP} = \frac{|\Delta_m|}{X_R} 100\%$$

Δ_m maximum absolute error

X_R the largest value of the measuring range



- ….

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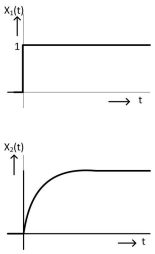
Dynamic properties

- **Step respons–**



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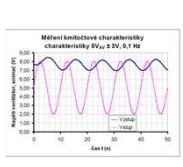
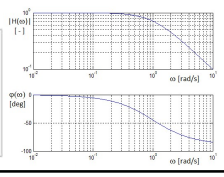
Dynamic properties

- **Frequency characteristic**





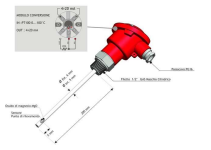
Requirements

- Principle of sensor
- …
- measurement of dimensions,
- …

Example sensor question

- **Principle**

°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms	°C	Ohms
-200	18.49	-137	43.11	-74	70.73	-11	95.89	51	119.78	114	143.80	177	167.33
-199	18.83	-136	43.52	-73	71.13			52	120.18	115	144.17	178	167.72
-198	19.16	-135	43.94	-72	71.53	-10	96.09	53	120.55	116	144.55	179	168.09
-197	19.70	-134	44.35	-71	71.93	-9	96.48	54	120.93	117	144.93		
-196	20.22	-133	44.76			-8	96.87	55	121.32	118	145.31	180	168.46
-195	20.65	-132	47.18	-70	72.33	-7	97.26	56	121.70	119	145.68	181	168.83
-194	21.08	-131	47.59	-69	72.73	-6	97.65	57	122.09			182	169.20
-193	21.51			-68	73.13	-5	98.04	58	122.47	120	146.06	183	169.57
-192	21.94	-130	48.00	-67	73.53	-4	98.44	59	122.86	121	146.44	184	169.94
-191	22.37	-129	48.41	-66	73.93	-3	98.83			122	146.81	185	170.31
		-128	48.82	-65	74.33	-2	99.22	60	123.24	123	147.19	186	170.68
-190	22.80	-127	49.23	-64	74.73	-1	99.61	61	123.63	124	147.56	187	171.05
-189	23.23	-126	49.64	-63	75.13			62	124.01	125	147.94	188	171.42
-188	23.66	-125	50.06	-62	75.53	0	100.00	63	124.39	126	148.32	189	171.79
-187	24.09	-124	50.47	-61	75.93	1	100.39	64	124.77	127	148.70		
-186	24.52	-123	50.88			2	100.78	65	125.16	128	149.07	190	172.16
-185	24.94	-122	51.29	-60	76.33	3	101.17	66	125.54	129	149.45	191	172.53
-184	25.37	-121	51.70	-59	76.73	4	101.56	67	125.92			192	172.90
									126.31	130	149.82	193	173.28
									126.69	131	150.20	194	173.65
										132	150.57	195	174.02
									127.07	133	150.95	196	174.37
									127.45	134	151.33	197	174.74
									127.84	135	151.70	198	175.10
									128.22	136	152.08	199	175.47
									128.60	137	152.45		
									128.98	138	152.83	200	175.84
									129.37	139	153.20	201	176.21
									129.75			202	176.57
									130.13	140	153.58	203	176.94
									130.51	141	153.95	204	177.31
										142	154.32	205	177.68
									130.89	143	154.70	206	178.04
									131.27	144	155.07	207	178.41
									131.66	145	155.45	208	178.78
									132.04	146	155.82	209	179.14
									132.42	147	156.19		
									132.80	148	156.57	210	179.51
									133.18	149	156.94	211	179.88
									133.56			212	180.24



What methods do you know of …

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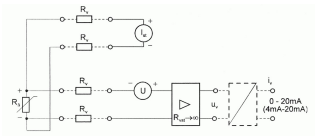
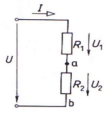
Example sensor question





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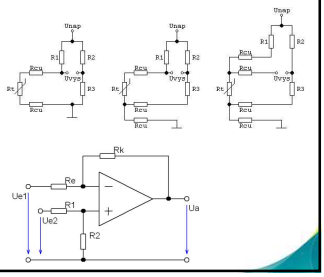
Example sensor question



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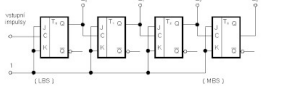
Example sensor question



číslo vstupního impulzu	výstupy klopných obvodů			
	Q_3	Q_2	Q_1	Q_0
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1
16	0	0	0	0

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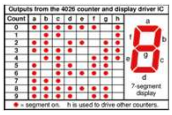
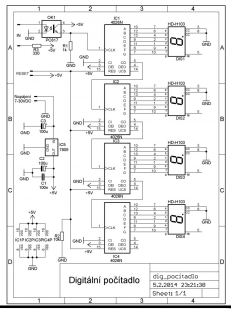
Example sensor question





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Example sensor question

$$\Delta R = f(\Delta t)$$

$$\Delta U \approx \Delta R$$

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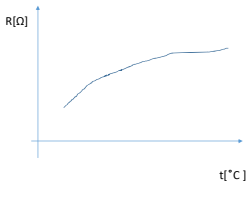
Example sensor question



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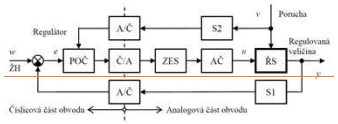
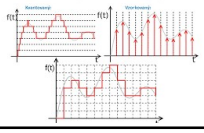
Example sensor question



Kvantovaný a vzorkovaný signál



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Example sensor question

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What was the content of the lecture

- An overview of the principles of sensors and sensors
  - Position
  - Distance
  - Temperature
  - Vibration
  - Force
  - ….
- Ways of evaluation
- Static properties
- Dynamic properties
- … .

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