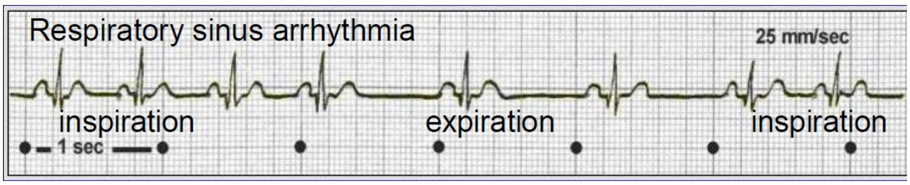
Arritmia sinusal respiratória – ASR (*Respiratory Sinus Arrhythmia* – RSA)

FONTE: http://www.physionet.org/events/hrv-2006/stauss.pdf



- Taquicardia durante a inspiração
- Bradicardia durante a expiração

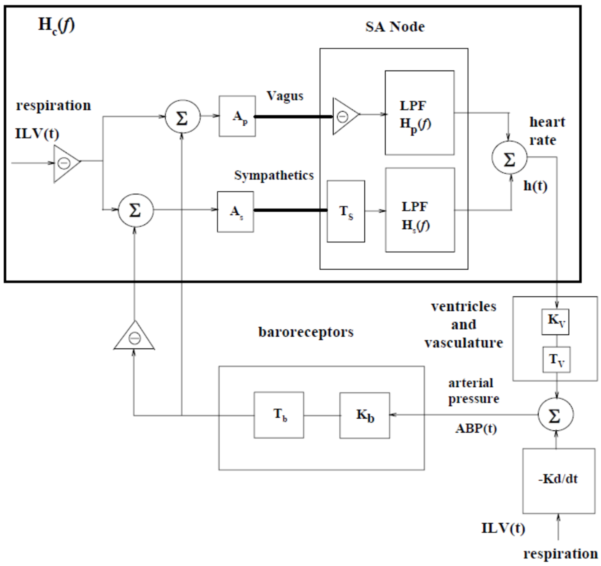
Resposta em frequência de um modelo de controle circulatório

Livro texto, capítulo 5, item 5.4.

- Ilustra e simula a regulação da taxa de batimento cardíaco e da pressão arterial por meio dos baroreceptores e pela respiração (por meio da arritmia sinusal respiratória e do acoplamento direto).

Explicações mais detalhadas do modelo: http://www.eee.metu.edu.tr/~ngencer/ee518/Lecture%20Notes/2013/Chapter%205/Chapter%205.pdf , slides 31 a 89

Saul Model of Heart Rate & Blood Pressure Control



Parasympathetic component
$H_p(f)$: cutoff freq = 0.2 Hz
$A_p = 2.5$, $K_p = 6$

Sympathetic component
$H_s(f)$: cutoff freq = 0.015 Hz
$T_s = 1.7$ sec
$A_s = 0.4$, $K_s = 18$

Transfer function analysis of the circulation: unique insights into cardiovascular regulation

Exercício 9, Lista 2

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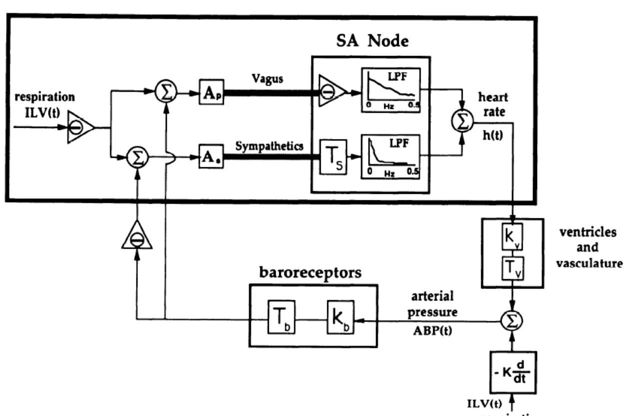
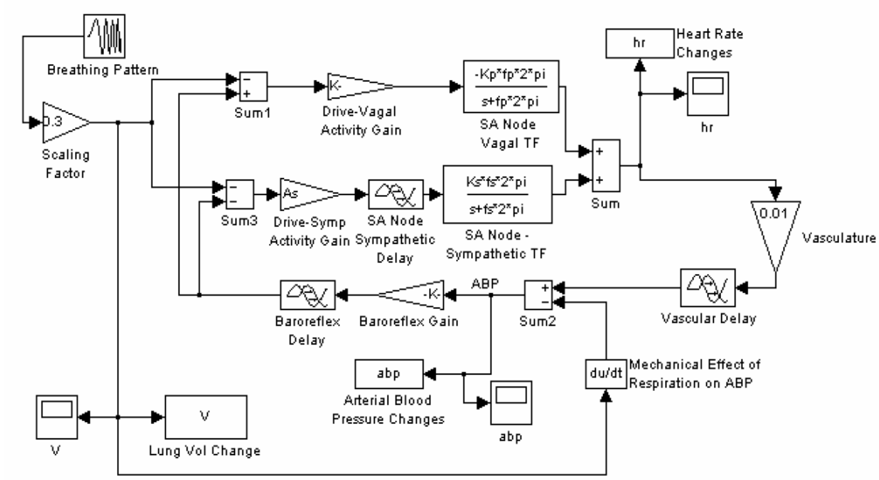


FIG. 9. Simple model of closed-loop cardiovascular regulation proposing that respiration (ILV) affects ABP both by directly inducing HR fluctuations (RSA) and by mechanical coupling to arterial vasculature within the thorax. A model for the RSA component was proposed previously and is enclosed by heavy black box (9). Mechanical component expresses itself as derivative of instantaneous lung volume. Model components are described in detail in APPENDIX A. LPF, low-pass filter.

Simulink implementation of Circulatory Control Model

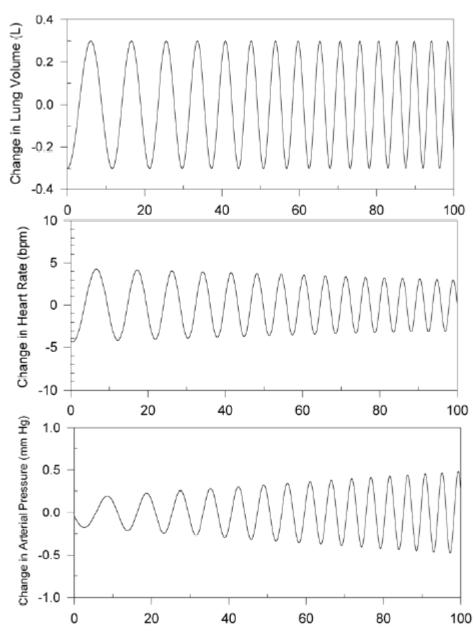
```
rsa.mdl
rsa_var.m
```



Freq. corte:

- f_p = 0,20 Hz
- f_s = 0,015 Hz

$$H(\omega) = \frac{S_{xy}(\omega)}{S_{xx}(\omega)}$$



```
% We assume the sampling interval is 0.1 s so that N=3000
%     for a total simulation time of 300 s

>> freq=[0:1/300:5]';
% compute Power spectrum of V and Cross-spectrum between
%      V and hr
>> Pv=psd(V,N,10);
>> Pvhr=csd(V,hr,N,10);

% compute Frequency Response magnitude and phase
>> Hvhr=Pvhr./Pv;
>> Hvhrmag=abs(Hvhr);
>> Hvhrpha=angle(Hvhr)*180/pi;
```

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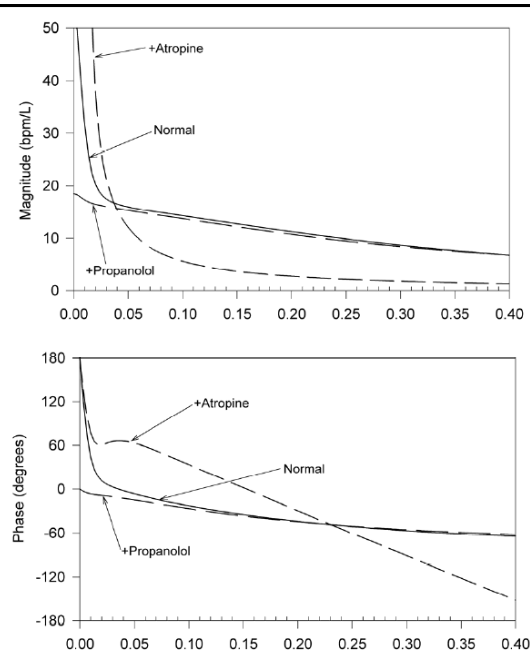

+Atropine =
Vagal Blockade
$A_p = 0.1$
$K_p = 1$
$f_p = 0.07$ Hz
$A_s = 4.0$
$K_s = 9$
$f_s = 0.015$ Hz

+Propanolol =
Beta Blockade
$A_p = 2.5$
$K_p = 6$
$f_p = 0.2$ Hz
$A_s = 0.1$
$K_s = 1$
$f_s = 0.015$ Hz

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Resposta em frequência da regulação de glicose e insulina

Livro texto, capítulo 5, item 5.5.

- Ilustra e simula um modelo de regulação de glicose e insulina proposto por Stolwijk e Hardy, mas limitado à análise do regime permanente.

Explicações mais detalhadas do modelo:
http://www.eee.metu.edu.tr/~ngencer/ee518/Lecture%20Notes/2013/Chapter%205/Chapter%205.pdf , slides 90 a 105.