Phase Plot of Rib Cage Breathing Signals

This document describes the interpretation of the XY-plot of rib cage breathing signals

Introduction

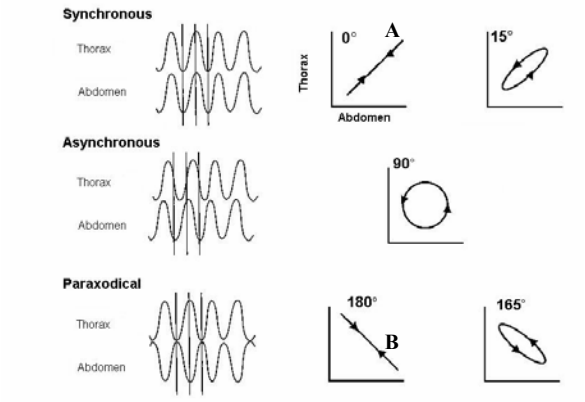
In normal breathing, chest and abdominal movements are synchronous. During abnormal breathing, chest and abdomen do not always move in synchrony, which is called thoraco-abdominal asynchrony. An extreme case of thoraco-abdominal asynchrony is paradoxical breathing. In sleep, thoraco-abdominal asynchrony is caused by obstruction of the airway.

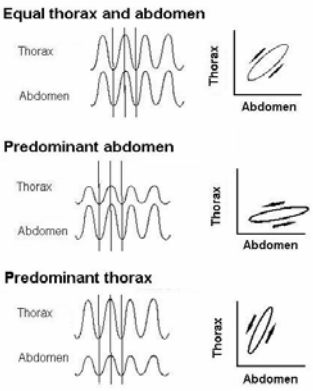
The phase relationship between the breathing signals can be represented graphically by an XY-plot, or phase plot, of chest and abdomen signals. This plot is also known as a Lissajou plot or a Konno-Mead plot.

Interpretation of the Plots

When abdomen and thorax movements change in synchrony, a straight-line is drawn in the X-Y plot at an angle of 45°. The loop opens up with the increase of asynchrony. It again closes to a straight line at a 135° angle, when the two signals show paradoxical breathing, i.e. abdomen increases and thorax decreases or vice versa.

Note that when the phase relationship between two signals is 0°, the graphical representation in the X-Y plot is a straight line at an angle of 45° (A). The opposite, a phase relationship of 180° will result in a line drawn at 135° (B).





A skewing of the loop towards the left or the right side indicates a predominance of the thorax or the abdomen movement respectively.

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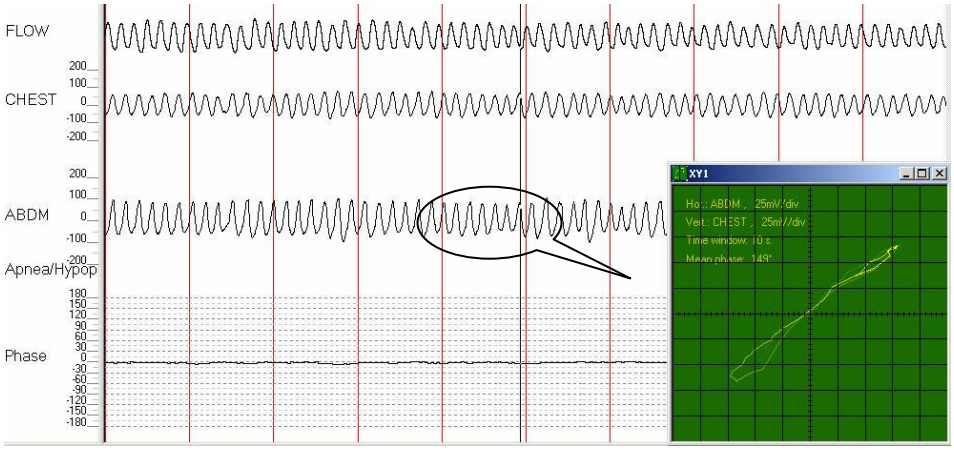
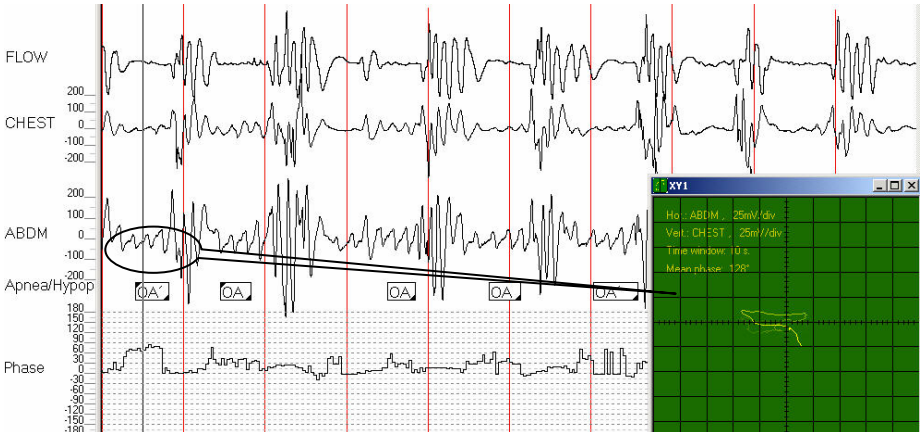
Examples from the Rembrandt X-Y Oscilloscope

Synchronous Breathing



Asynchronous Breathing

Paradoxical Breathing during Obstructive Apnea



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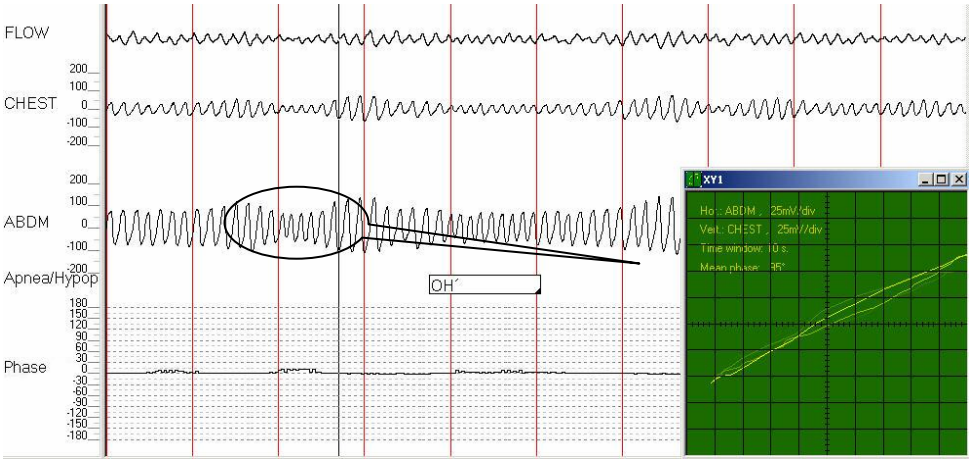
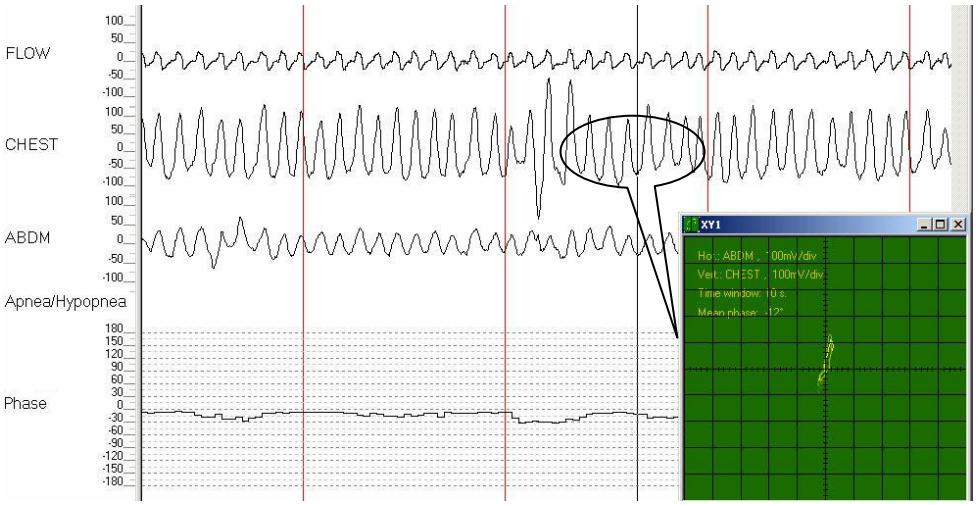
Synchronous Breathing before Obstructive Hypopnea



Paradoxical Breathing during Central Apnea

Chest Effort Signal - Higher Amplitude than Abdominal Effort Signal:



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Further Information

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