

POLITECNICO DI TORINO

Corso di Laurea in Ingegneria Aerospaziale

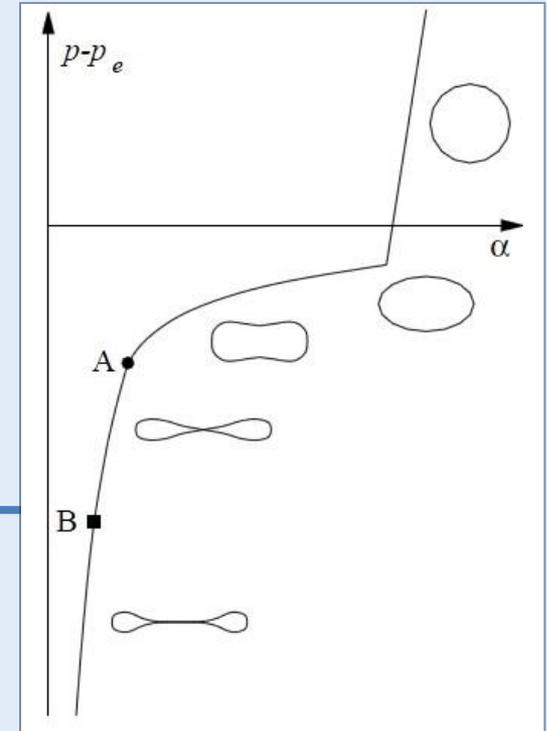
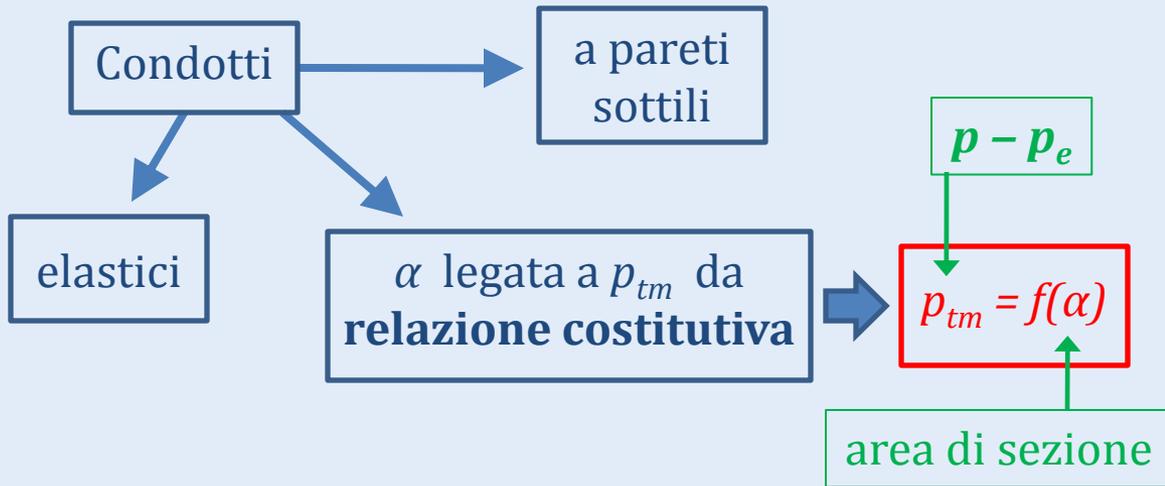
Analisi e descrizione di flussi in tubi collassabili attraverso studi sperimentali

Relatore:
Ing. Stefania Scarsoglio

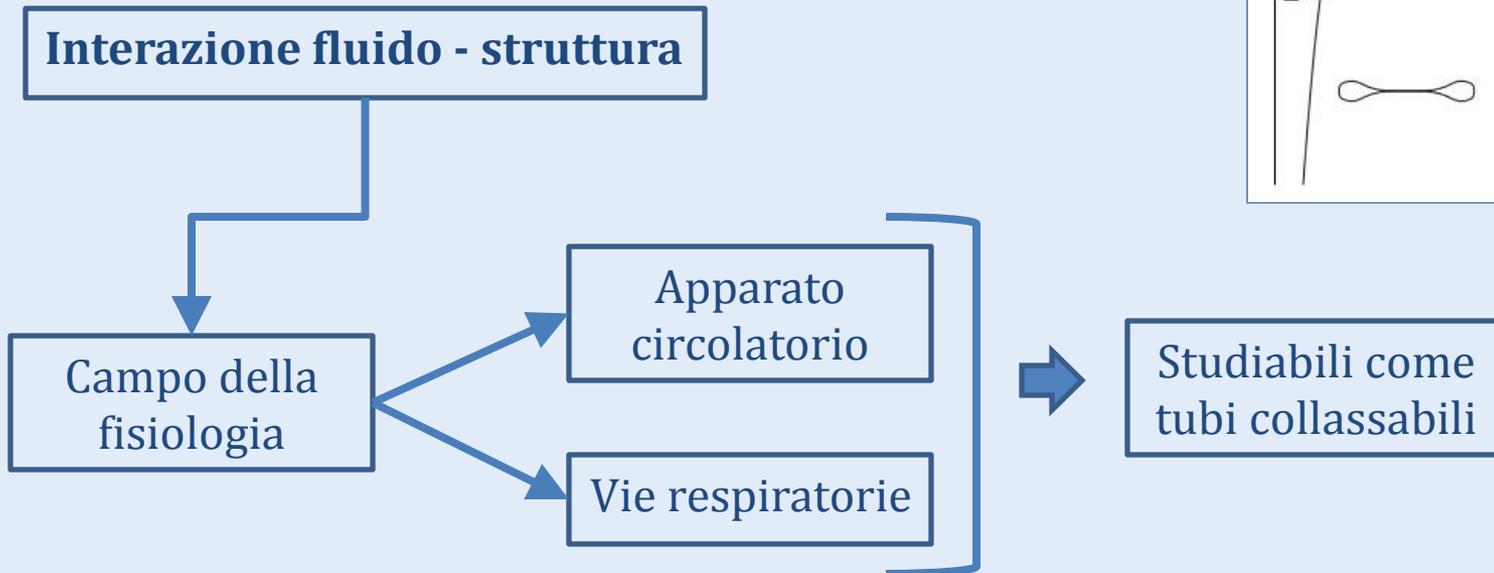
Candidato:
Luca Bonino

Luglio 2014

Definizione e Motivazioni degli studi

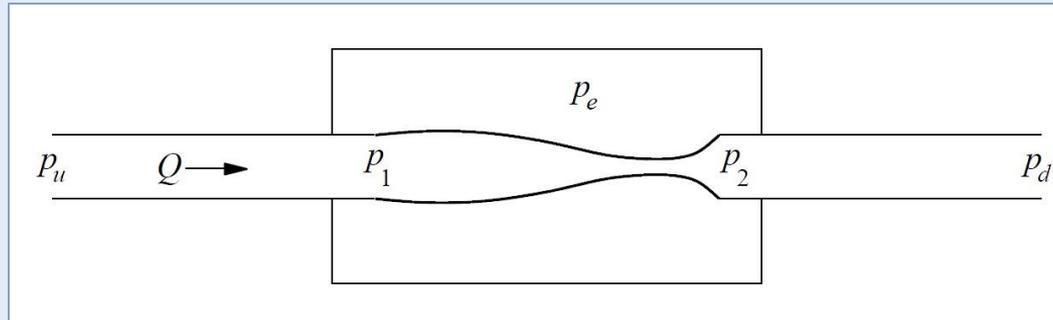


Interazione fluido - struttura

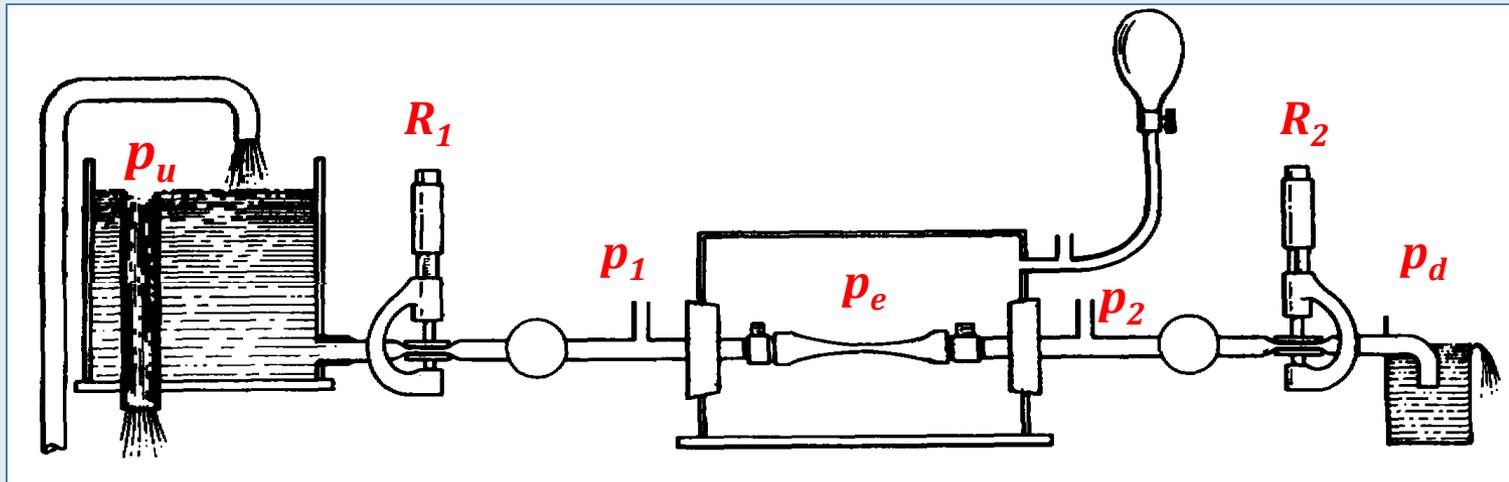


L'apparecchiatura

Resistore di
Starling:

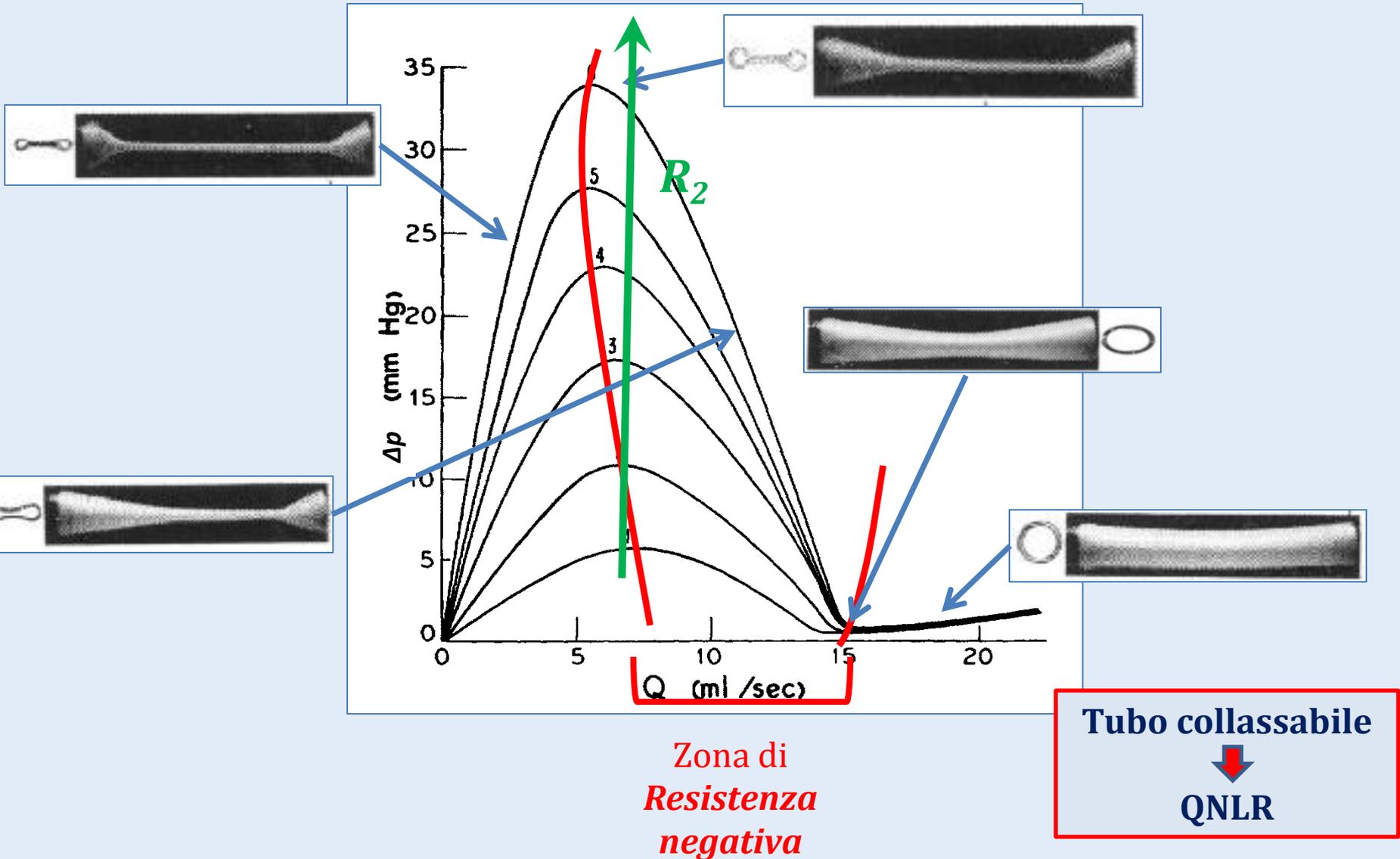


Apparecchiatura
introdotta da Holt:



I primi risultati (Conrad, 1969, Katz *et al.*, 1969)

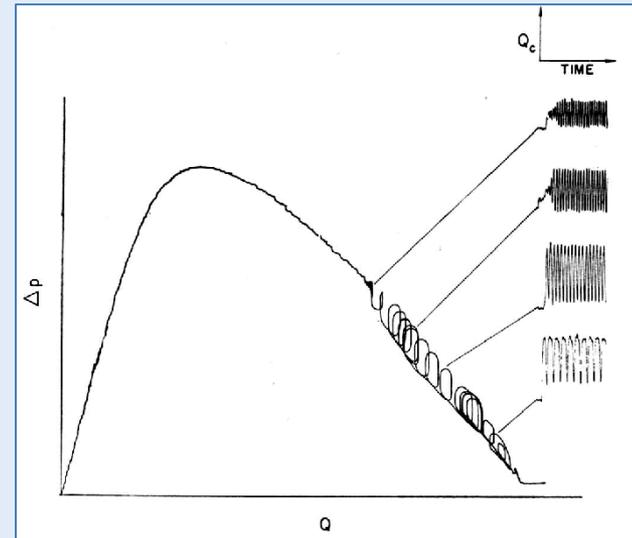
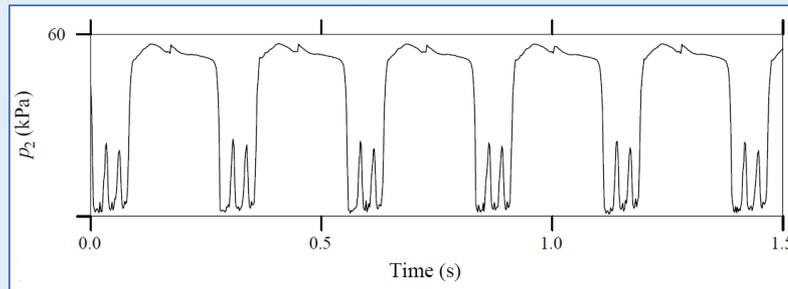
Variando R_1 e mantenendo p_e costante, per diversi valori di R_2 .



Fenomeni particolari

Oscillazioni auto - eccitate

- Larga ampiezza
- Frequenze tra 1 – 100 Hz



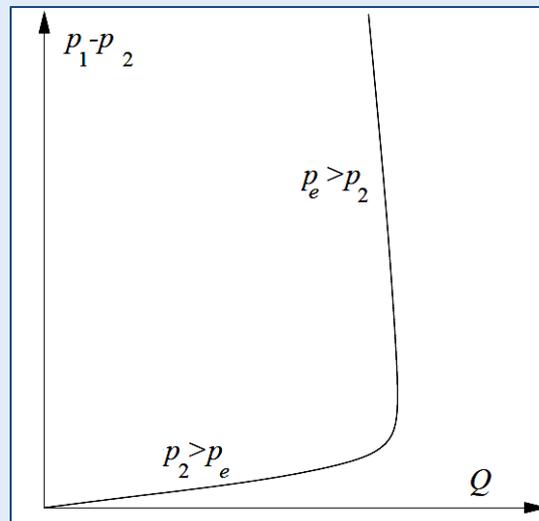
Limitazione della portata

Andando a ridurre p_2 :

da $p_2 > p_e$



a $p_2 < p_e$

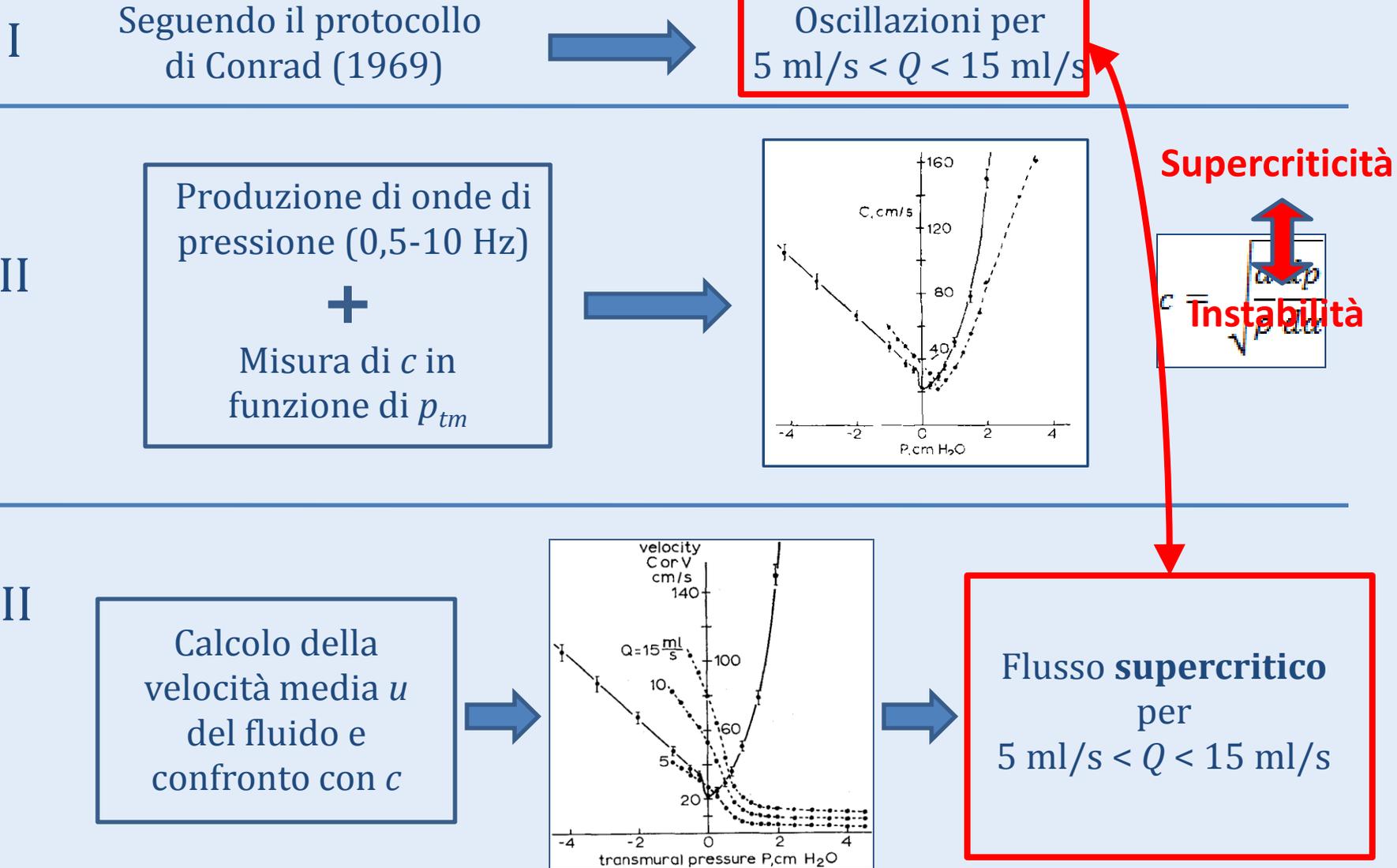


Se $p_2 < p_e$ la portata **non** viene più influenzata da variazioni di p_2



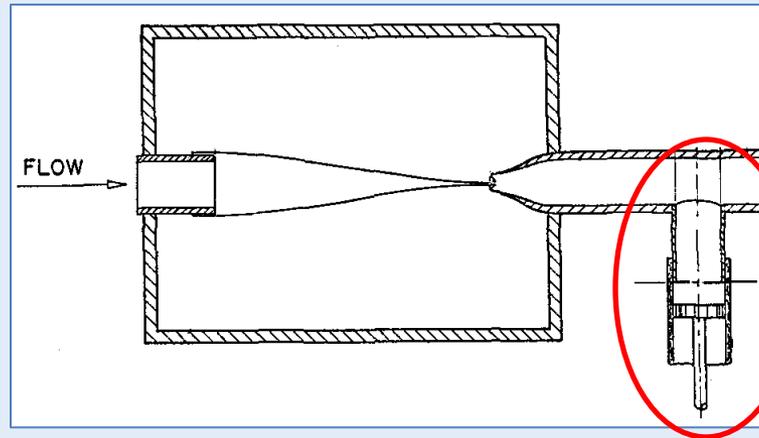
“Effetto cascata”

Brower e Scholten (1975)



Conrad et al. (1978)

Adattamento del
resistore di Starling



**Pistone
mobile a
valle**

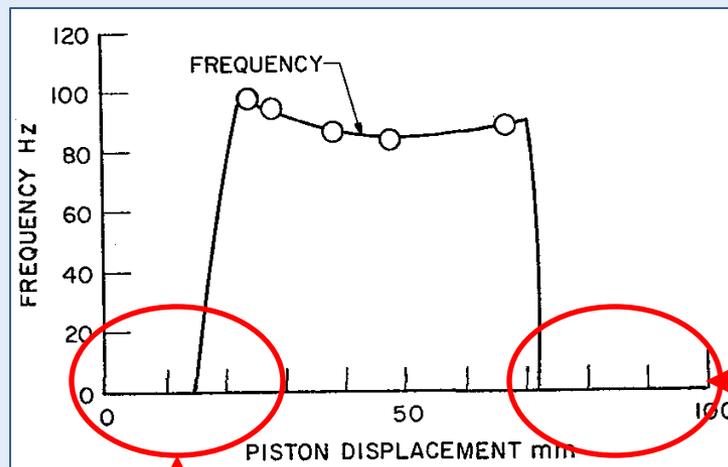
Si è in una condizione in cui si
hanno oscillazioni (~100 Hz)

Flusso supercritico

?

Le condizioni di valle
influenzano le oscillazioni

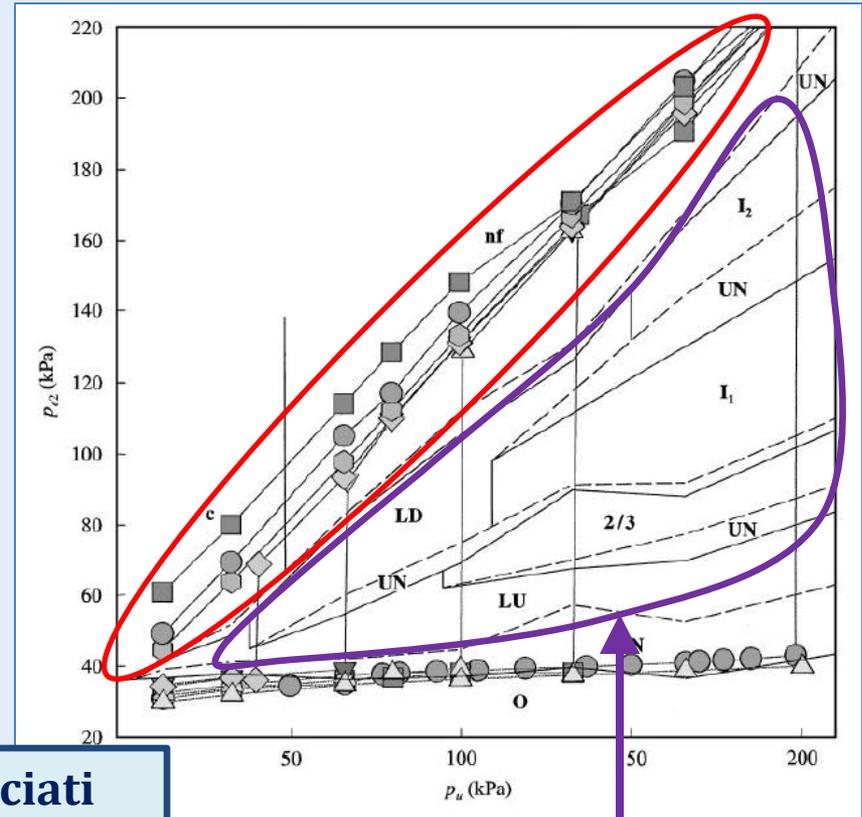
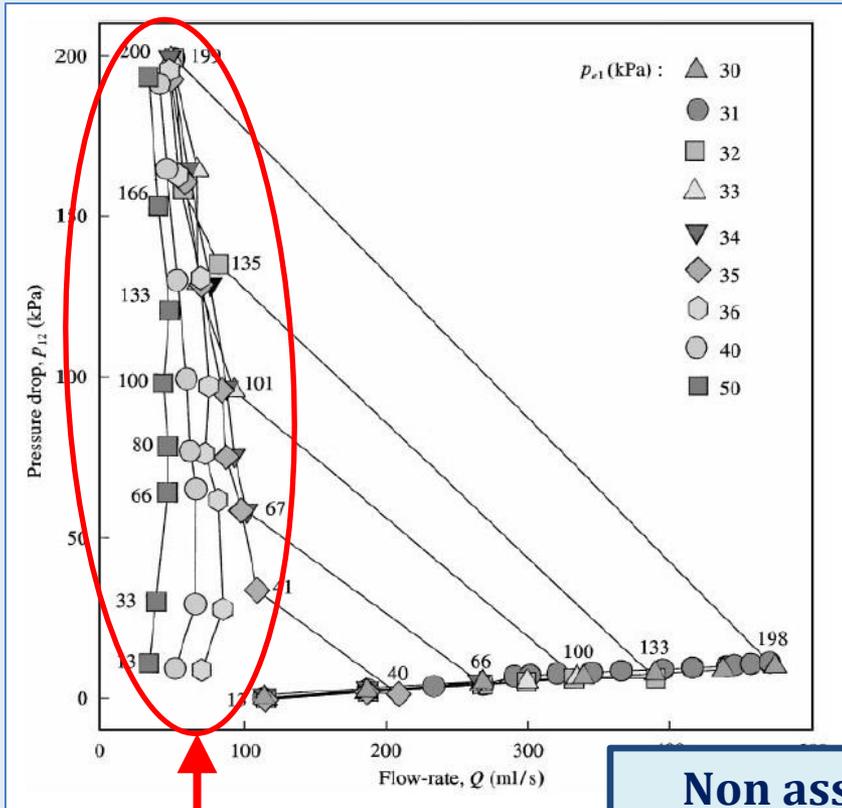
Variando la
posizione del
pistone:



Per queste
posizioni del
pistone le
**oscillazioni
si fermano**

Bertram e Castles (1998)

Aumentando p_e , per diverse $p_{e1} = p_e - p_1$



Non associati necessariamente

Limitazione della portata

Oscillazioni

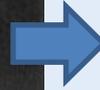
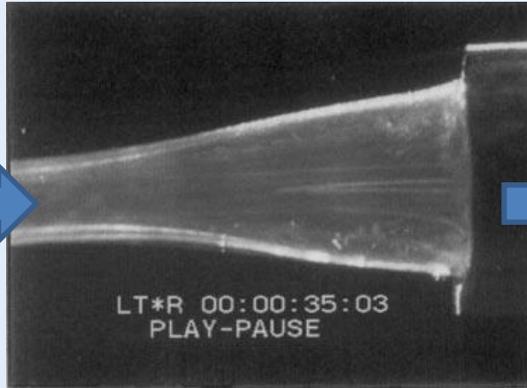
Kounanis e Mathioulakis (1998)

Utilizzando la velocimetria laser Doppler (LDV)



Visualizzazione del campo di moto

Viene diminuita Q agendo su R_1



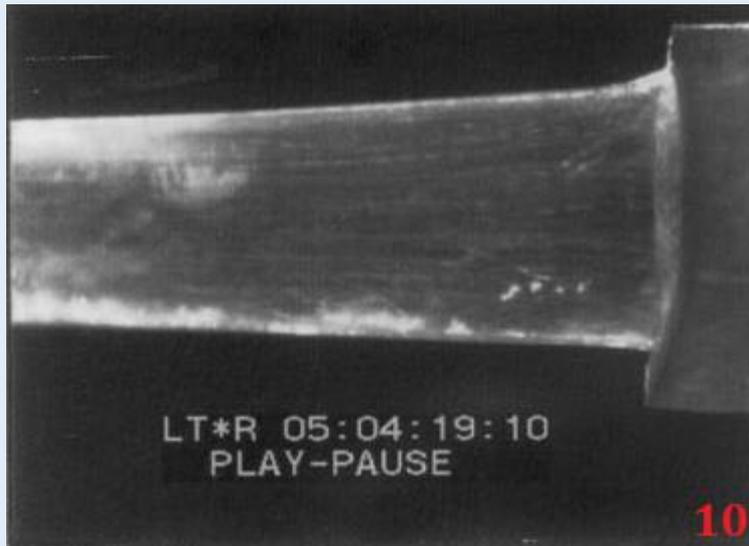
Aumentando ancora R_1



Evidente asimmetria del flusso

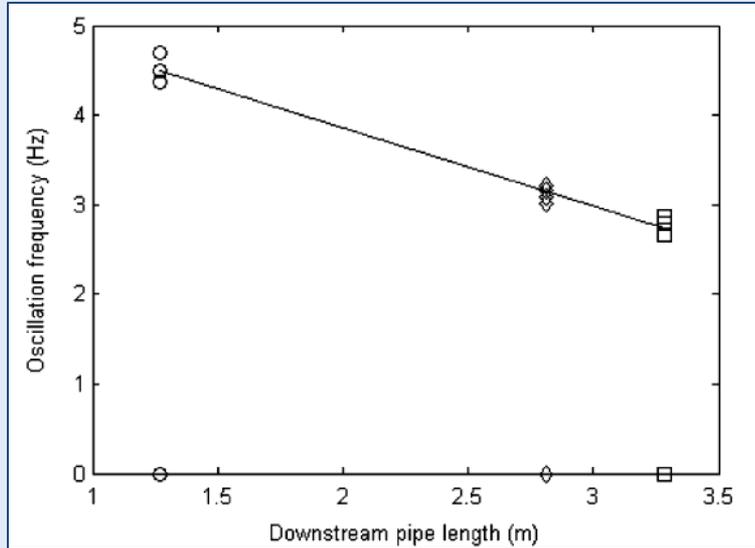


Insorgono oscillazioni

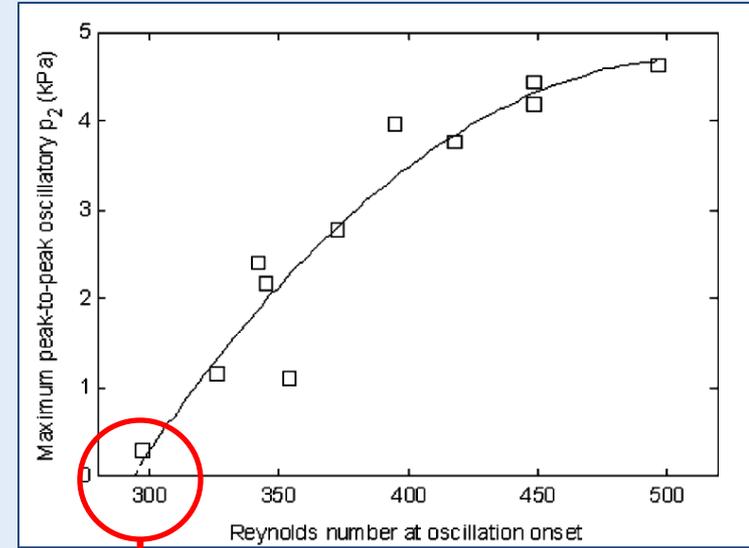


Bertram e Tscherry (2006)

Frequenza - Lunghezza
del condotto a valle



Massima ampiezza di p_2 -
Numero di Reynolds



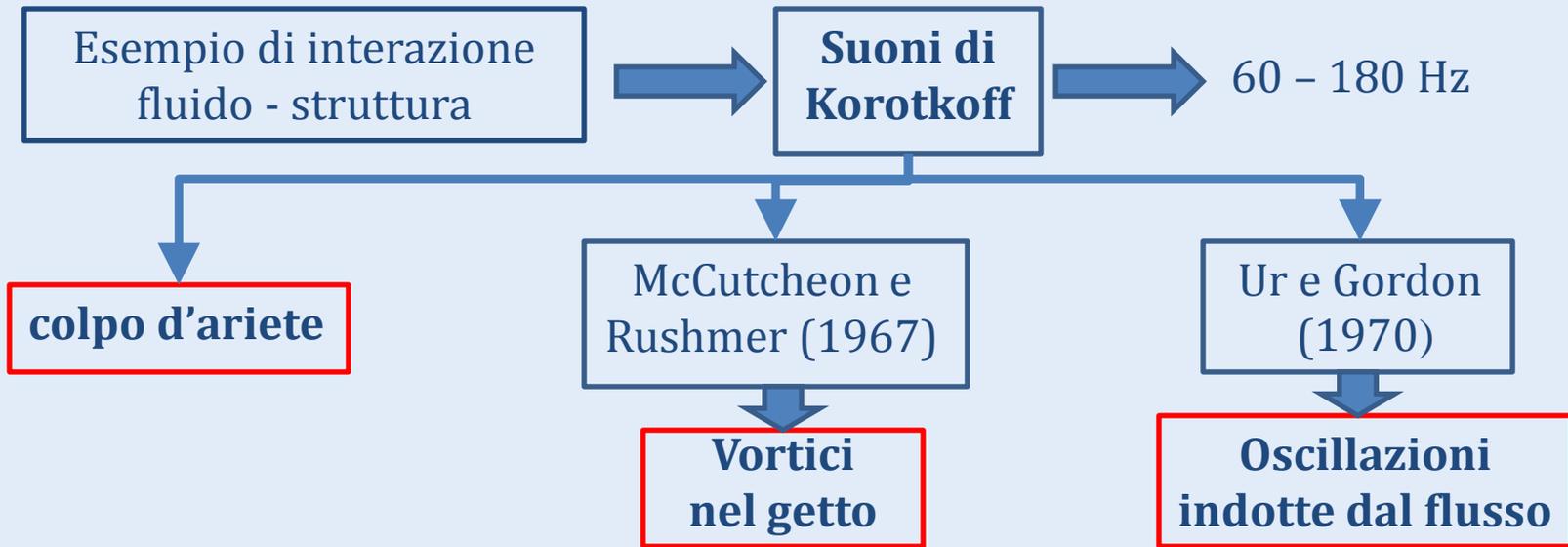
Aumenta l'inerzia

Inertanza
 $I = \rho L/A$

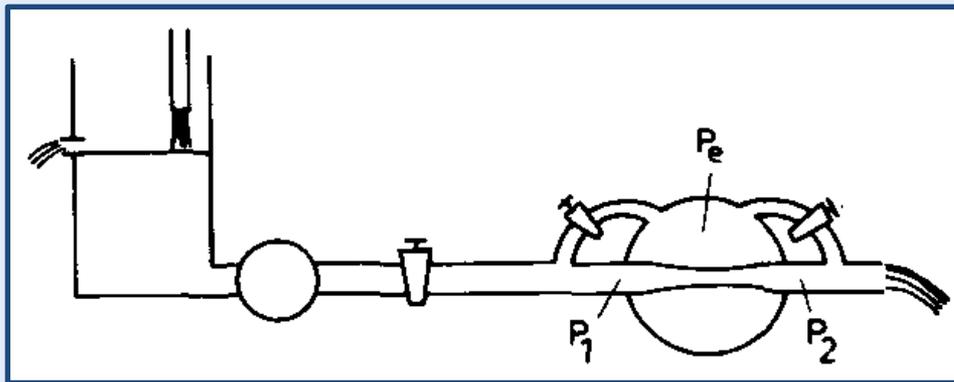
$Re_{\min} \approx 290$

Applicazioni biomediche

La misura della pressione arteriosa



Modello per l'auto-regolazione



Se la p_u cresce
(e quindi anche Q)

p_e aumenta,
maggior collasso

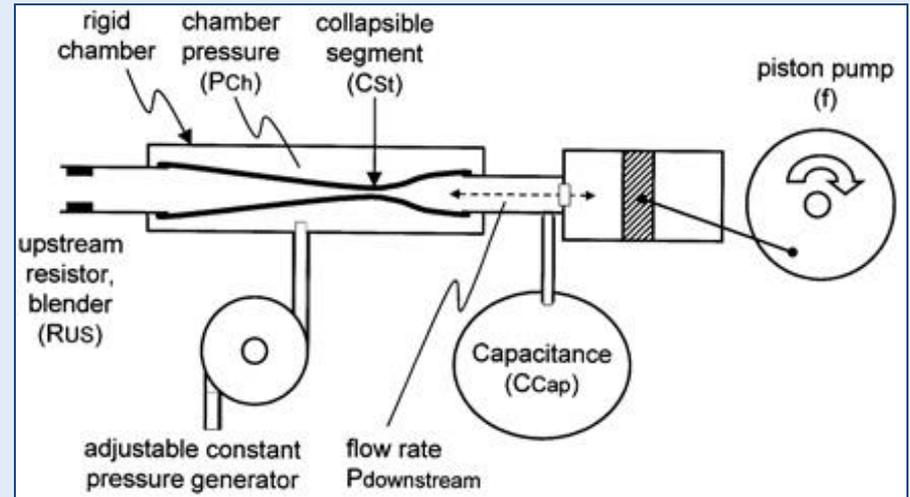
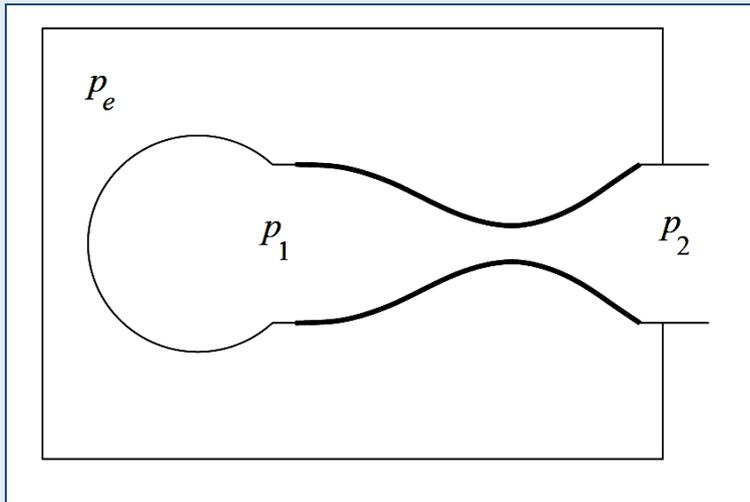
Aumenta la
resistenza

Sistema di
controllo

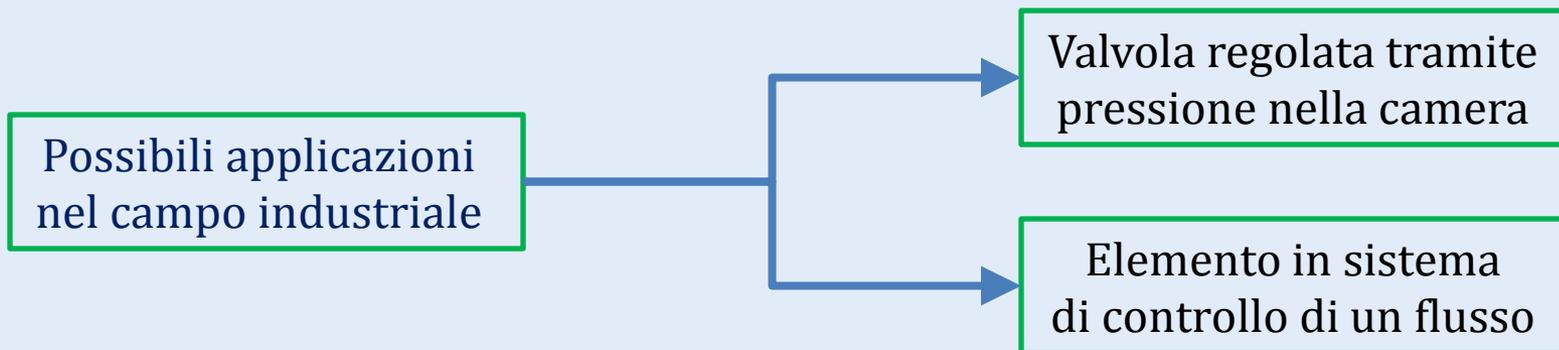
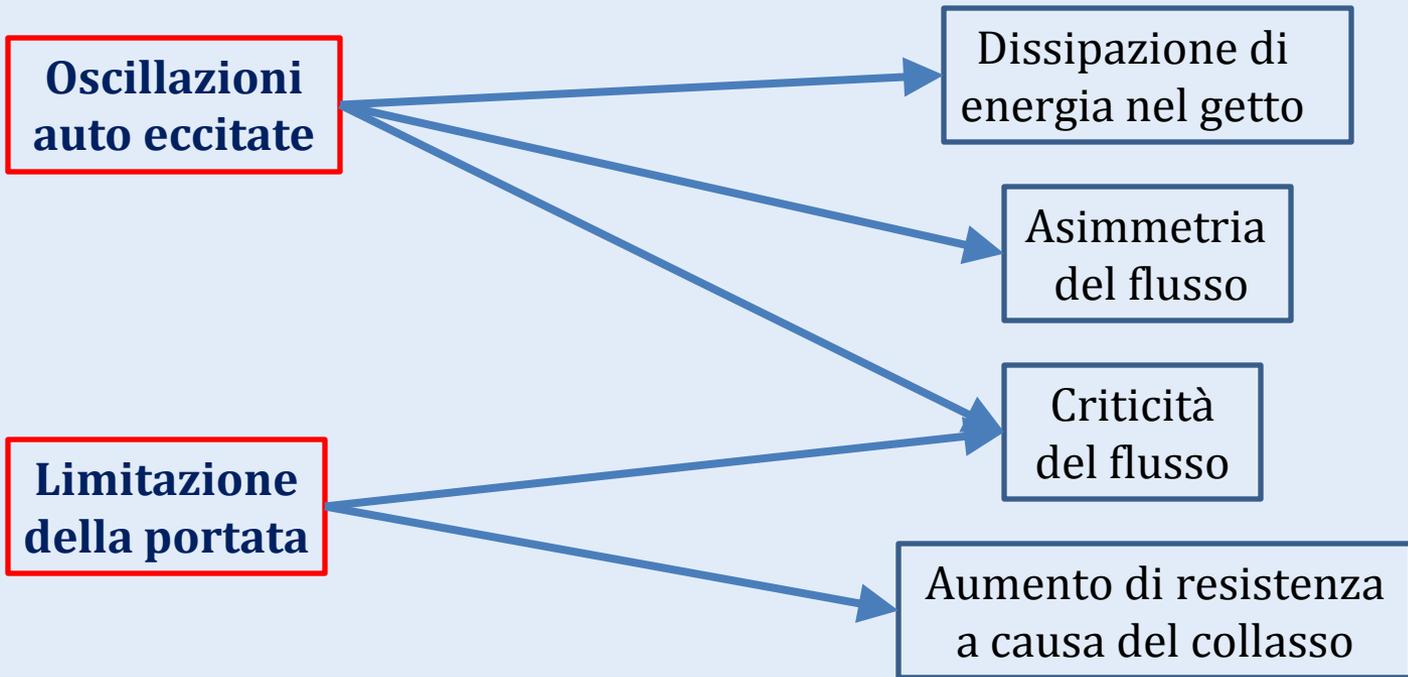
Applicazioni biomediche



Modelli per lo studio delle vie respiratorie



Conclusioni



Grazie per l'attenzione