

Periode der $M = 2,197 \frac{\text{NSM}}{\text{S}}$ $M_g = 0,547$

(214)

$$L = 0.625 \text{ m}$$

$$\frac{L}{D} = 6.25$$

$$\frac{46L}{D} = 0.25 < L^*$$

PUNTO Z

$$\frac{46L^*}{D} = \frac{46L^*}{D} - \frac{46L}{D} = 4.719$$

FA

$$M_4 = 0.312$$

$$P_4 = 3.48$$

$$P_4 = 3.48 \cdot 26.41 = 91.94 \text{ kPa}$$

Im molto analogo per i punti V e T

PUNTO	M	P (Pa)
Z	0.312	91.94
V	0.5995	66.62
T	1.429	17.06
S	0.778	37.80

$$\text{NOTO } M_T \xrightarrow{\text{NSW}} M_S = 0.728 \xrightarrow{\text{FA}} \frac{P}{P^*} = 1.43$$

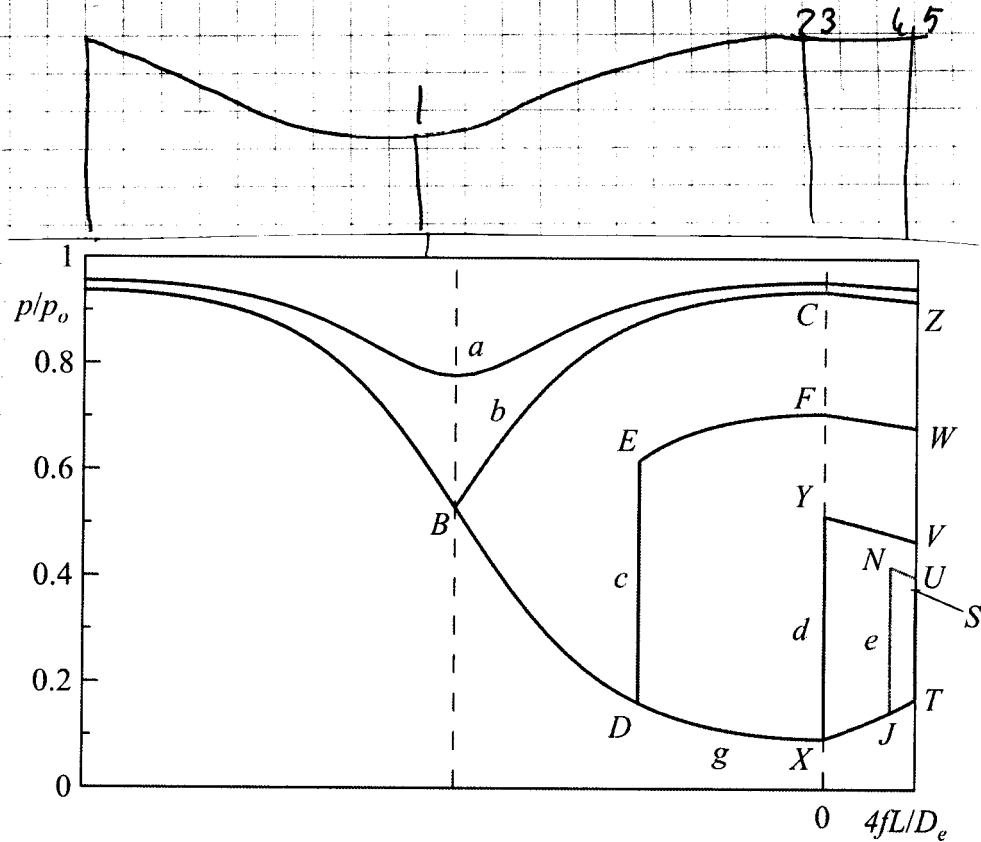
$$P_0 = 93 \text{ Pa}$$

motore sub si procede per tentativi si osserva il processo

$$M_2 = 0.15 \xrightarrow{\text{FA}} \frac{P_2}{P^*}$$

$$\frac{46L_2^*}{D} \rightarrow \frac{46L_2^*}{D} = \frac{46L_2^*}{D} + \frac{46L}{D} \xrightarrow{\text{FA}} M_C \xrightarrow{\text{ISO}} \frac{P_C}{P_0}$$

$$P_2 = \frac{P_2}{P^*} \frac{P^*}{P_C} \frac{P_C}{P_0} P_0 \rightarrow F = \frac{P_2 - P_0}{P_0} \rightarrow \text{Fella Raggiatori}$$



pa	93 sub		2 ingresso condotto				5 uscita			
5 uscita										
M	p/p*	4fl*	4fl*	M	p/p*	p/po	p	err%	M	
0.15	7.2866	27.932	28.182	0.1494	7.3161	0.9845	98.056	5.436	0.135	
0.135	8.0997	35.199	35.449	0.1346	8.1261	0.9874	98.421	5.8293	0.3573	
0.3573	3.0271	3.2501	3.5001	0.3483	3.1072	0.9195	89.58	-3.6779	0.2713	
0.2713	4.008	6.8958	7.1458	0.2676	4.0649	0.9515	93.813	0.8746	0.2879	
0.2879	3.7744	5.9136	6.1636	0.2833	3.8355	0.9458	93.072	0.0773	0.2895	
0.2895	3.7532	5.8278	6.0778	0.2849	3.8147	0.9452	92.998	-0.0021	0.2894	
0.2894	3.7538	5.83	6.08	0.2848	3.8152	0.9452	93	5E-06	0.2894	
0.2894	3.7538	5.83	6.08	0.2848	3.8152	0.9452	93	3E-10	0.2894	

$P_0 = 68,03 P_0$

onda nel divergente

$\frac{P_0}{P^*} = 2,576 \xrightarrow{FA}$

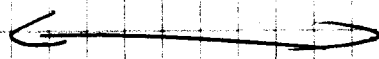
$M_N = 0,418$
 $\frac{46L^*}{D} = 2,006$

$\frac{46L^*}{D} = \frac{4L}{D} + \frac{46L^*}{D} = 2,254$

$M = 0,403 \xrightarrow{ISO} \frac{P}{P^*} = 0,811$
 $\frac{P_F}{P^*} = 2,675$

$\frac{P_{OF}}{P} = \frac{P_{OF}}{P_F} \frac{P_F}{P^*} \frac{P^*}{P} = \frac{0,811 \cdot 2,675}{0,894 \cdot 100} = 26,61 = 0,790$
 $\downarrow MSW$

$M_0 = 1,85$



$P_0 = 39,90 P_0$ onda nel condotto si procede con Terzaghi

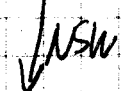
Usando $\frac{L}{D}$ come variabile γ ho (Vedi esempio Fanno 1)

pa	39.904	Onda nel condotto								
l/d sho	4fL23/D	4fL2c/D	M3	M4	4fL4c/D	4fL45/D	4fL5c/D	M5	p5/pc	p5
5	0.2	0.1602	1.5663	0.6789	0.2523	0.05	0.2023	0.703	1.4864	39.262
6	0.24	0.1202	1.4565	0.7171	0.1771	0.01	0.1671	0.7231	1.4415	38.076
4.4595	0.1784	0.1818	1.6263	0.6607	0.2961	0.0716	0.2245	0.6918	1.5127	39.958
4.5034	0.1801	0.18	1.6214	0.6621	0.2925	0.0699	0.2226	0.6927	1.5106	39.9
4.5003	0.18	0.1802	1.6218	0.662	0.2927	0.07	0.2227	0.6927	1.5107	39.904
4.5003	0.18	0.1802	1.6218	0.662	0.2927	0.07	0.2227	0.6927	1.5107	39.904
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4.5003	0.18	0.1802	1.6218	0.662	0.2927	0.07	0.2227	0.6927	1.5107	39.904

Se si usa M_0 come variabile γ ho: ($M_0 = 2,197$, $\frac{46L^*}{D} = 0,36$ $\frac{46L}{D} = 0,25$)

pa	39.904	Onda nel condotto								
2										
M	4fL*	4fL/D								
2.1972	0.3602	0.25								
3			4		5					
M	4fL*	4fL23/D	M	4fL*	4fL*	M	p/p*	p	Err%	
2	0.305	0.0552	0.5774	0.5879	0.393	0.6272	1.6816	44.417	11.31	1.4
1.5	0.1361	0.2241	0.7011	0.206	0.1802	0.7153	1.4587	38.529	-3.4445	1.6167
1.6167	0.1784	0.1818	0.6635	0.289	0.2208	0.6936	1.5085	39.845	-0.1477	1.622
1.622	0.1802	0.1799	0.6619	0.2929	0.2228	0.6926	1.5108	39.906	0.0059	1.6218
1.6218	0.1802	0.18	0.662	0.2927	0.2227	0.6927	1.5107	39.904	-7E-06	1.6218
1.6218	0.1802	0.18	0.662	0.2927	0.2227	0.6927	1.5107	39.904	-3E-10	1.6218

$M_0 = 2 \xrightarrow{FA} \frac{46L^*}{D} = 0,305 \rightarrow \frac{46L_{x3}}{D} = \frac{46}{D} (L^* - L^*) = 0,0552$



$M_N = 0,577 \xrightarrow{FA} \frac{46L^*}{D} = 0,5779$
 $\frac{46L^*}{D} = \frac{46}{D} [L^* - (L - L_{x3})] = 0,393 \xrightarrow{FA} M_0 = 0,627$
 $\frac{P}{P^*} = 1,682$

$P_0 = \frac{P_0}{P^*} P^* = 44,42 P_0 \rightarrow \text{Terzaghi}$

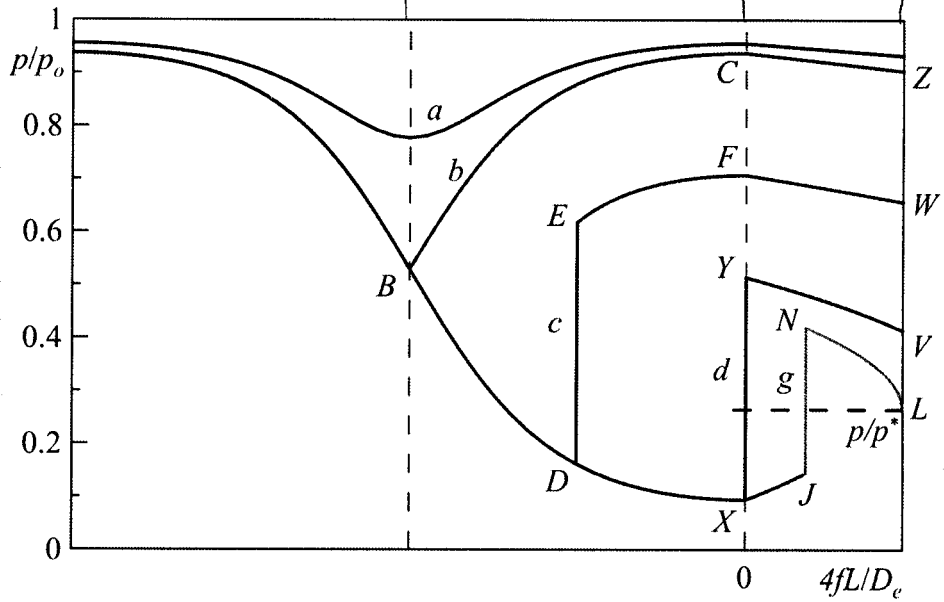
$$L = 1181 \text{ m}$$

$$\frac{L}{D} = 11.81$$

$$\frac{4fL}{D} = 0.4724$$

14 moduli analizzati al
cavo preesistente in
tunnel

Punto	M	P (Pa)
Z	0.317	90.32
V	0.671	41.30



$P_0 = 93.242$ mda subsonico 2° prevede re Turbulen

pa	93.242	sub								
5 uscita			2 ingresso condotto				5 uscita			
M	p/p*	4fl*	4fl*	M	p/p*	p/p0	p	err%	M	
0.15	7.2866	27.932	28.404	0.1489	7.3423	0.9846	97.717	4.8111	0.135	
0.135	8.0997	35.199	35.671	0.1342	8.1496	0.9875	98.145	5.2717	0.3067	
0.3067	3.539	4.9951	5.4675	0.2965	3.6624	0.9408	90.912	-2.5058	0.2514	
0.2514	4.3309	8.3696	8.842	0.2459	4.4286	0.9588	93.765	0.5616	0.2615	
0.2615	4.161	7.5778	8.0502	0.2553	4.2633	0.9557	93.276	0.0362	0.2622	
0.2622	4.1498	7.5268	7.9992	0.2559	4.2524	0.9555	93.242	-0.0006	0.2622	
0.2622	4.15	7.5277	8.0001	0.2559	4.2526	0.9555	93.242	7E-07	0.2622	
0.2622	4.15	7.5277	8.0001	0.2559	4.2526	0.9555	93.242	1E-11	0.2622	

$P_0 = 65.564$ / onli divergenza
cavo primario ($M_2 = 1.85$)

$P_0 = 35$ / onli conduttore
cavo primario

Punto L $P_0 = P^*$ S prevede re Turbulen (M_2)

$$M_2 = 1.2 \xrightarrow{FA} \frac{4fL^*}{D} = 0.0336$$

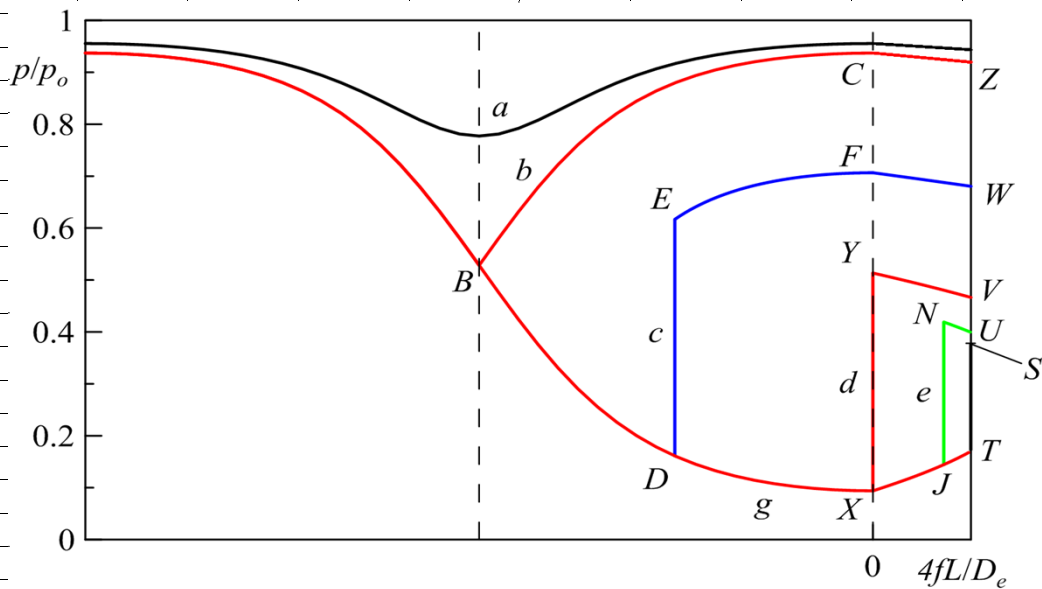
↓ NSW

$$M_2 = 0.842 \xrightarrow{FA} \frac{4fL^*}{D} = 0.0409$$

$$\frac{4fL_{XL}}{D} = \frac{4f(L_x^* - L_s^* + L_N^*)}{D} = 0.3675$$

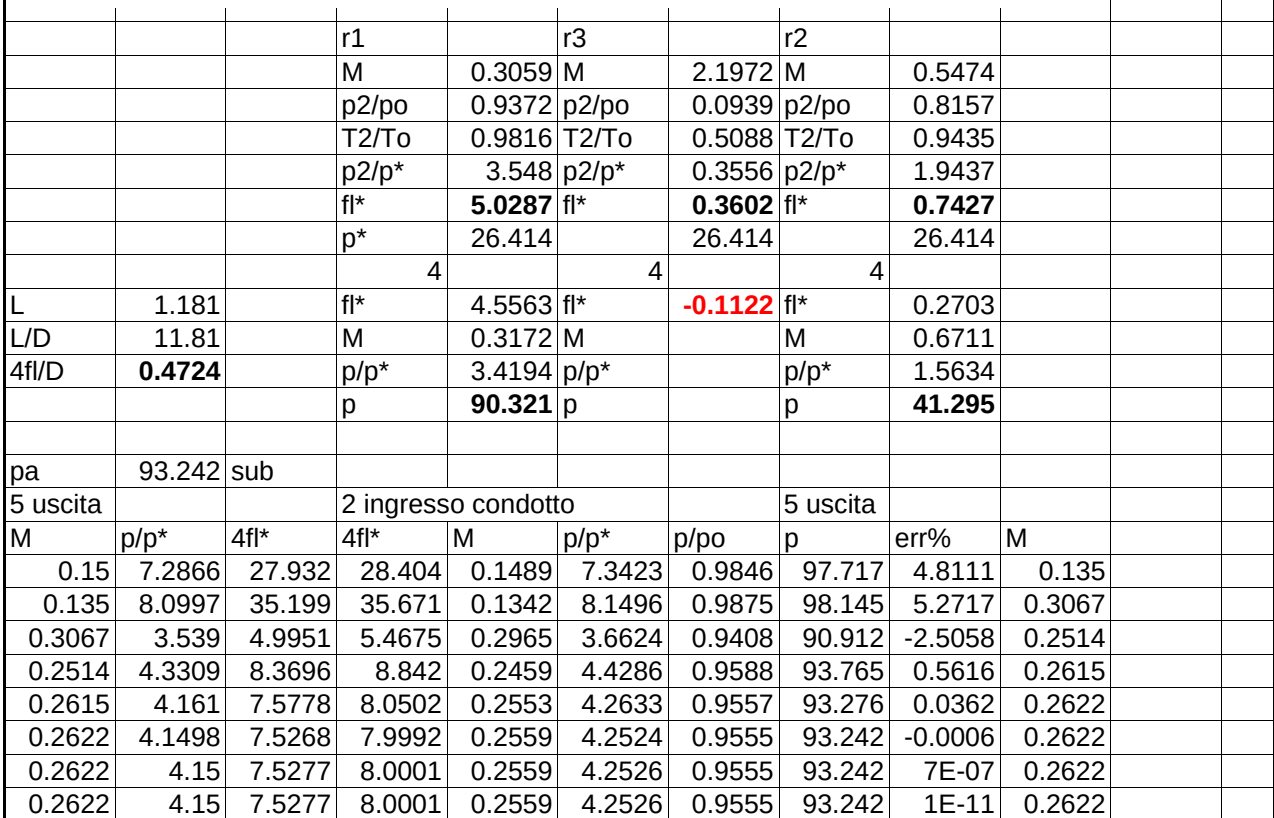
$$E = \frac{\frac{4fL_{XL}}{D} - \frac{4fL}{D}}{\frac{4fL}{D}} = -22\%$$

3	4	tot	Err%	
M	4fl*	M	4fl*	4fl
1.2	0.0336	0.8422	0.0409	0.3675
1.4	0.0997	0.7397	0.1415	0.402
1.808	0.2445	0.6147	0.4356	0.5513
1.5925	0.1696	0.6707	0.2712	0.4618
1.6181	0.1788	0.6631	0.29	0.4713
1.6209	0.1799	0.6622	0.2921	0.4724
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A2/A1	2	r1	r3	r2					
D	0.1 m	M	0.3059 M	2.1972 M	0.5474				
f	0.01	p2/po	0.9372	p2/po	0.0939	p2/po	0.8157		
po	100 jPa	T2/To	0.9816	T2/To	0.5088	T2/To	0.9435		
To	290 K	p2/p*	3.548	p2/p*	0.3556	p2/p*	1.9437		
		fl*	5.0287	fl*	0.3602	fl*	0.7427		
	m	p*	26.414		26.414		26.414	26.414	
		4	4	4	5				
L	0.625	fl*	4.7787	fl*	0.1102	fl*	0.4927	Mvalle	0.7278
L/D	6.25	M	0.3117	M	1.4289	M	0.5995		
4fL/D	0.25	p/p*	3.4807	p/p*	0.646	p/p*	1.7648	P/p*	1.4312
		p	91.939	p	17.063	p	46.617	p	37.803
pa	93 sub								
5 uscita		2 ingresso condotto		5 uscita					
M	p/p*	4fl*	4fl*	M	p/p*	p/po	p	err%	M
0.15	7.2866	27.932	28.182	0.1494	7.3161	0.9845	98.056	5.436	0.135
0.135	8.0997	35.199	35.449	0.1346	8.1261	0.9874	98.421	5.8293	0.3573
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0.2713	4.008	6.8958	7.1458	0.2676	4.0649	0.9515	93.813	0.8746	0.2879
0.2879	3.7744	5.9136	6.1636	0.2833	3.8355	0.9458	93.072	0.0773	0.2895
0.2895	3.7532	5.8278	6.0778	0.2849	3.8147	0.9452	92.998	-0.0021	0.2894
0.2894	3.7538	5.83	6.08	0.2848	3.8152	0.9452	93	5E-06	0.2894
0.2894	3.7538	5.83	6.08	0.2848	3.8152	0.9452	93	3E-10	0.2894

[illegible]



[illegible]