Research Article

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General formula for the evaluation of linear load losses

Abstract

The main objective of this technical article is to unify the diversity of criteria, formulas, tables, diagrams, abacuses, photos, etc. They exist for calculating the coefficients of hydraulic resistances (CCH Chezy, nM Manning, fW-D, Weisbach-Darcy, CWH, Williams Hazen), and then evaluate the losses of linear load in the lines of any geometric shape, and working without pressure for review and search of the international literature and the Internet, respectively, the formula proposed by the French engineer recognized. A. Chézy in 1769, as the first, which is also considered as a paradigm of hydraulic channels. Until, in 1789, the Irish Engineer R. Manning presented his formula, which is most commonly used today. And the Darcy-Weisbach formula which is considered to be of universal application and the Hazen Williams practiced in the case of water conveyance.

The author of this white paper, to conduct an analysis of the above equations and compare them with the general formula of fluid resistance, says that the latter has the attributes of all of them and with the advantage that it is applicable to any laminar or turbulent flow with and without pressure and for all possible cases geometrically duct. In other works, the author has exposed the deduction of the general law of fluid resistance from the fundamental equation of hydrodynamics (Bernoulli). That is the principle of energy applied to the fluid flow.

Keywords: load losses, hydraulic resistance coefficients

Volume 2 Issue 6 - 2018

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Received: November 14, 2018 | **Published:** December 12, 2018

Introduction

As an antecedent to mention, of the here proposed as the general formula for the computation of linear load losses. That is, the general law of fluid resistance (1765). It is the fundamental equation of hydrodynamics, (Bernoulli, 1738), which is the origin of it. It is necessary to clarify that the general formula of fluid resistance is the foundation of the equations of.[1] The equation proposed here can be used to solve an infinity of the theoretical-practical problems of the most important that occur in hydraulics in a general way as it is the determination of the linear load losses in the pipes. How often students, designers, researchers, etc. We have seen the need to select a method to calculate the head losses in a given hydraulic problem, sometimes it is more difficult to select the method to be used than to give the solution to the problem. Unbelievably often the situation is solved in such a simple way that we have overlooked it, this case is one of them. The author states that it would be very healthy to use the general formula of fluid resistance to calculate linear load losses, because this provides the results that best represent the real conditions of the problem, because it is a law, that is, it takes into account the relationships between the elements that participate in the phenomenon. The author cites the article. ID (0229NS), "General formulas for the Chezy and Manning coefficients". In which it was demonstrated that these are only particular cases applicable conceptually applicable to the category of full turbulent flow, (rough). That is, when the pair, (Re, ε/Di), is located in the zone of complete turbulence, (quadratic resistance zone in the Moody diagram). On or above the dashed line.

This proposal pursues, obtaining the most accurate and accurate results of the problem analyzed in a simple and quick way within the existing limitations in the solution of this problem.

Methodology

The deductive method is used. The author acknowledges that it is recurrent in relation to the deduction of the general formula of fluid resistance based on the fundamental equation of hydrodynamics, (Bernoulli). The fundamental reasons are, the Bernoulli equation, is the law of conservation of energy and / or conservation of the amount of movement applied to the flow of fluids and because one of the main questions of hydraulics is solved efficiently and correctly, as is the determination of linear load losses. Not by insisting there is unnecessary repetition. The undersigned stresses that, the Weisbach-Darcy formula, is a particular case of the general law of fluid resistance, for the calculation of linear load losses in pipes fully filled.

$$hf = C_R * \frac{L}{R_h} * \frac{V^2}{2g} = f_{D-W} * \frac{L}{D_i} * \frac{V^2}{2g} = 4C_R * \frac{L}{4R_h} * \frac{V^2}{2g}$$

Observar:

$$\tau_0 = C_R * \rho * \frac{V^2}{2} \quad \tau_0 = \frac{fW-D}{4} * \rho * \frac{V^2}{2} \quad \& \quad \tau_0 = \gamma * R_h * S$$

$$C_R * \rho * \frac{V^2}{2} = \rho * g * R_h * S = \frac{fW-D}{4} * \rho * \frac{V^2}{2}$$

Por tanto:

$$S = C_R * \frac{1}{R_h} * \frac{V^2}{2g} = f_{W-D} * \frac{L}{Di} * \frac{V^2}{2g}, -f_{W-D} = 4C_R, y, -Di = 4R_h$$

Deduction of the general form of fluid resistance shows in Figure 1

$$P_1A - P_2A - \gamma ALSen\ \alpha = \tau_0 PL$$

$$\div \gamma A$$

$$\frac{P_1A}{\gamma A} - \frac{P_2A}{\gamma A} - \frac{\gamma ALSen}{\gamma A}\ \alpha = \frac{\tau_0 PL}{\gamma A}$$

$$\frac{P_1A}{\gamma A} - \frac{P_2A}{\gamma A} - LSen\,\alpha = \frac{\tau_0 PL}{\gamma A}$$

$$Sen\,\alpha = \left(\frac{h_2 - h_1}{L}\right)$$

$$\left[\left(\frac{P_1}{\gamma} - \frac{P_2}{\gamma}\right) - (h_2 - h_1)\right] = hf$$

$$hf = \frac{\tau_0 * P * L}{\gamma * A}$$

$$\tau_0 = C_R * \rho * \frac{V^2}{2}$$

$$\frac{P}{A} = \frac{1}{R}\quad \frac{\rho}{\gamma} = \frac{1}{g}$$

$$hf = C_R * \frac{L}{R} * \frac{V^2}{2g}$$

That is the general law of fluid resistance.

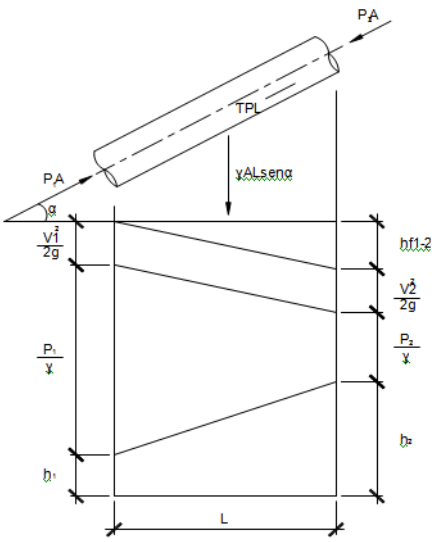

Figure 1 Deduction of the general form of fluid resistance.

Results and discussion

By means of calculations in Excel, using the general formula of fluid resistance, in order to evaluate linear load losses later, we will demonstrate the veracity of the foregoing.

Before proceeding with the examples, we want to specify the scope and limitation of the formulas discussed above.

i. Formula of A. Chezy,[1]

Considered as a paradigm of channel hydraulics, it is a particular case, conceptually valid for the category of full turbulent flow, (rough). Coincides with the zone of complete turbulence in the Moody diagram, are the points that are located on or above the dashed line, (the influence of the Reynolds number is ignored).

ii. Formula of R. Manning,[1]

It has the same scope and limitation as Chezy's. But it has been the most used in recent times in free conductions. The caveat is made, that if in 1 and 2, the formulas proposed by the author in the article are used. ID (0229NS), "General formulas for the Chezy and Manning coefficients". The results are correct, that is, they coincide with those of the formula proposed here.

iii. Formula of Weisbach-Darcy, (1855).

It is the general equation of the fluid resistance, but to be used specifically in pipes working under pressure, it is valid for the three possible categories of turbulent flow, (full, transitional and smooth), that is to say for the three zones of the Moody diagram, (quadratic resistance, transition and curve for smooth tubes).

iv. General formula of the fluid resistance, (1765).

It is the law for the evaluation of linear load losses. That is, valid for all possible cases of hydraulic problems of linear load losses. Calculation by trial and error of the dimensions of the sections, triangular, rectangular, trapezoidal and partially circular and completely filled respectively. Data and results of the conductions. Q, Ks, γ, S. Same for all examples. (for the rectangular case, the channel is real).

Ex.1: Triangular cannel (Table 1).

Table 1 Triangular channel

Q_d	Ks	n	h	m
0.0297	0.00025	0.000001	0.1634	1.5
0.0327	0.00025	0.000001	0.16947	1.5
0.0483	0.00025	0.000001	0.19645	1.5
0.0511	0.00025	0.000001	0.2007	1.5
0.0628	0.00025	0.000001	0.21703	1.5
0.0655	0.00025	0.000001	0.22052	1.5
0.0722	0.00025	0.000001	0.22882	1.5
0.0874	0.00025	0.000001	0.24605	1.5
0.1024	0.00025	0.000001	0.2613	1.5
0.1075	0.00025	0.000001	0.26618	1.5

Citation: Medina OJ. General formula for the evaluation of linear load losses. *Int J Hydro.* 2018;2(6):726‒735. DOI: 10.15406/ijh.2018.02.00150

A	P	R	V_r	Re_m	C_{Rm}	C_{CHm}	n_m
0.04005	0.58915	0.06798	0.742	201647	0.00521	61.341	0.01041
0.04308	0.61103	0.0705	0.759	214064	0.00516	61.659	0.01042
0.05789	0.70831	0.08173	0.834	272762	0.00495	62.941	0.01047
0.06042	0.72363	0.0835	0.846	282463	0.00492	63.126	0.01047
0.07065	0.78251	0.09029	0.889	321017	0.00482	63.801	0.0105
0.07294	0.7951	0.09174	0.898	329520	0.0048	63.939	0.0105
0.07854	0.82502	0.09519	0.919	350051	0.00475	64.257	0.01052
0.09081	0.88715	0.10236	0.962	394073	0.00466	64.88	0.01054
0.10242	0.94213	0.10871	1	434759	0.00459	65.395	0.01056
0.10628	0.95973	0.11074	1.012	448045	0.00457	65.553	0.01057

	C_{Rm}			fw-d		
fw-d	S_m	a	Suα	Su	α	Suα
0.02086	0.00215	1.04472	0.002246	0.00215	1.04472	0.002246
0.02064	0.00215	1.04429	0.002245	0.00215	1.04429	0.002245
0.01981	0.00215	1.04258	0.002242	0.00215	1.04258	0.002242
0.01969	0.00215	1.04234	0.002241	0.00215	1.04234	0.002241
0.01928	0.00215	1.04149	0.002239	0.00215	1.04149	0.002239
0.0192	0.00215	1.04132	0.002239	0.00215	1.04132	0.002239
0.01901	0.00215	1.04093	0.002238	0.00215	1.04093	0.002238
0.01864	0.00215	1.04018	0.002236	0.00215	1.04018	0.002236
0.01835	0.00215	1.03958	0.002235	0.00215	1.03958	0.002235
0.01826	0.00215	1.0394	0.002235	0.00215	1.0394	0.002235

Ex.2: Canal rectangular (Table 2).

Ex.3: Canal trapezoidal (Table 3).

Ex.4: Circular canal. (Partially filled pipe) (Table 4).

Ex.4.1: For the maximum expense, (h/Di=0.95).

Ex.4.2: For the maximum speed, (h/Di=0.813).

Ex.4.3: For the pipeline occupied halfway, (h/Di=0.50).

Ex.5: Circular pipe. (Pipe completely filled) (Table 5).

Table 2 Triangular channel

Qd	Ks	n	g	b	h	m
0.0297	0.00025	0.000001	9.81	0.4	0.10097	0
0.0327	0.00025	0.000001	9.81	0.4	0.10803	0
0.0483	0.00025	0.000001	9.81	0.4	0.14293	0
0.0511	0.00025	0.000001	9.81	0.4	0.14894	0
0.0628	0.00025	0.000001	9.81	0.4	0.17345	0
0.0655	0.00025	0.000001	9.81	0.4	0.179	0
0.0722	0.00025	0.000001	9.81	0.4	0.19263	0
0.0874	0.00025	0.000001	9.81	0.4	0.22285	0
0.1024	0.00025	0.000001	9.81	0.4	0.252	0
0.1075	0.00025	0.000001	9.81	0.4	0.2618	0

A	P	R	V	Re_m	C_{Rm}	C_{CHm}	n_m
0.04039	0.60194	0.0671	0.73537	197362	0.00523	61.227	0.01041
0.04321	0.61606	0.07014	0.75673	212317	0.00517	61.615	0.01042
0.05717	0.68586	0.08336	0.84482	281690	0.00493	63.112	0.01047
0.05958	0.69788	0.08537	0.85773	292887	0.00489	63.318	0.01048
0.06938	0.7469	0.09289	0.90516	336323	0.00478	64.046	0.01051
0.0716	0.758	0.09446	0.9148	345646	0.00476	64.19	0.01051
0.07705	0.78526	0.09812	0.93703	367776	0.00471	64.517	0.01053
0.08914	0.8457	0.1054	0.98048	413385	0.00463	65.131	0.01055
0.1008	0.904	0.1115	1.01587	453097	0.00456	65.612	0.01057
0.10472	0.9236	0.11338	1.02655	465570	0.00454	65.754	0.01058

	C_{Rm}			fc		
fc	Su	α	Suα	Su	α	Suα
0.02093	0.00215	1.04488	0.002246	0.00215	1.04488	0.002246
0.02067	0.00215	1.04435	0.002246	0.00215	1.04435	0.002246
0.0197	0.00215	1.04236	0.002241	0.00215	1.04236	0.002241
0.01958	0.00215	1.0421	0.00224	0.00215	1.0421	0.00224
0.01913	0.00215	1.04119	0.002239	0.00215	1.04119	0.002239
0.01905	0.00215	1.04101	0.002238	0.00215	1.04101	0.002238
0.01885	0.00215	1.04061	0.002237	0.00215	1.04061	0.002237
0.0185	0.00215	1.03989	0.002236	0.00215	1.03989	0.002236
0.01823	0.00215	1.03933	0.002234	0.00215	1.03933	0.002234
0.01815	0.00215	1.03917	0.002234	0.00215	1.03917	0.002234

Table 3 Canal trapezoidal

	Ks	n	g	b	h	m
0.0297	0.00025	0.000001	9.81	0.4	0.08174	1.5
0.0327	0.00025	0.000001	9.81	0.4	0.08634	1.5
0.0483	0.00025	0.000001	9.81	0.4	0.1075	1.5
0.0511	0.00025	0.000001	9.81	0.4	0.11092	1.5
0.0628	0.00025	0.000001	9.81	0.4	0.1243	1.5
0.0655	0.00025	0.000001	9.81	0.4	0.1272	1.5
0.0722	0.00025	0.000001	9.81	0.4	0.13416	1.5
0.0874	0.00025	0.000001	9.81	0.4	0.1488	1.5
0.1024	0.00025	0.000001	9.81	0.4	0.162	1.5
0.1075	0.00025	0.000001	9.81	0.4	0.16625	1.5

	Ks	n	g	b	h	m
0.0297	0.00025	0.000001	9.81	0.4	0.08174	1.5
0.0327	0.00025	0.000001	9.81	0.4	0.08634	1.5
0.0483	0.00025	0.000001	9.81	0.4	0.1075	1.5
0.0511	0.00025	0.000001	9.81	0.4	0.11092	1.5
0.0628	0.00025	0.000001	9.81	0.4	0.1243	1.5
0.0655	0.00025	0.000001	9.81	0.4	0.1272	1.5
0.0722	0.00025	0.000001	9.81	0.4	0.13416	1.5
0.0874	0.00025	0.000001	9.81	0.4	0.1488	1.5
0.1024	0.00025	0.000001	9.81	0.4	0.162	1.5
0.1075	0.00025	0.000001	9.81	0.4	0.16625	1.5

	C_{Rm}			Fw-d		
fc	**Su**	**α**	**Suα**	**Su**	**α**	**Suα**
0.02147	0.00215	1.04597	0.002249	0.00215	1.04597	0.002249
0.02119	0.00215	1.04541	0.002247	0.00215	1.04541	0.002247
0.02017	0.00215	1.04331	0.002243	0.00215	1.04331	0.002243
0.02003	0.00215	1.04303	0.002243	0.00215	1.04303	0.002243
0.01954	0.00215	1.04202	0.00224	0.00215	1.04202	0.00224
0.01944	0.00215	1.04182	0.00224	0.00215	1.04182	0.00224
0.01922	0.00215	1.04137	0.002239	0.00215	1.04137	0.002239
0.01881	0.00215	1.04052	0.002237	0.00215	1.04052	0.002237
0.01848	0.00215	1.03984	0.002236	0.00215	1.03984	0.002236
0.01838	0.00215	1.03964	0.002235	0.00215	1.03964	0.002235

Table 4 Canal circular

Q_d	Ks	n	g	Di	h/Di	h
0.0297	0.00025	0.000001	9.81	0.23019	0.93	0.21408
0.0327	0.00025	0.000001	9.81	0.23872	0.93	0.22201
0.0483	0.00025	0.000001	9.81	0.27674	0.93	0.25737
0.0511	0.00025	0.000001	9.81	0.28272	0.93	0.26293
0.0628	0.00025	0.000001	9.81	0.3057	0.93	0.2843
0.0655	0.00025	0.000001	9.81	0.31062	0.93	0.28888
0.0722	0.00025	0.000001	9.81	0.32234	0.93	0.29978
0.0874	0.00025	0.000001	9.81	0.3466	0.93	0.32234
0.1024	0.00025	0.000001	9.81	0.3681	0.93	0.34233
0.1075	0.00025	0.000001	9.81	0.37494	0.93	0.34869

Observe:

For the maximum expense, (h/Di=0.95). <Say, that: For the maximum speed, (h/Di=0.813) and that: For the pipeline occupied halfway, (h/Di=0.50).

Citation: Medina OJ. General formula for the evaluation of linear load losses. *Int J Hydro.* 2018;2(6):726–735. DOI: 10.15406/ijh.2018.02.00150

Table 4.1 For the maximum expense, (h/Di=0.95)

b	A	P	R	V	Re	C_R	n
149.3166	0.04034	0.59989	0.06724	0.736	198036	0.00523	0.01041
149.3166	0.04338	0.62212	0.06973	0.754	210249	0.00518	0.01042
149.3166	0.0583	0.7212	0.08084	0.828	267886	0.00497	0.01046
149.3166	0.06085	0.73679	0.08258	0.84	277421	0.00494	0.01047
149.3166	0.07114	0.79667	0.08929	0.883	315311	0.00483	0.01049
149.3166	0.07345	0.8095	0.09073	0.892	323658	0.00481	0.0105
149.3166	0.07909	0.84004	0.09416	0.913	343793	0.00477	0.01051
149.3166	0.09145	0.90326	0.10124	0.956	387041	0.00467	0.01054
149.3166	0.10314	0.95929	0.10752	0.993	426981	0.0046	0.01056
149.3166	0.10701	0.97712	0.10952	1.005	440070	0.00458	0.01057

For the maximum expense, (h/Di=0.95). >CR and <nM, that: For the maximum speed, (h/Di=0.813) and that: For the pipeline occupied halfway, (h/Di=0.50).

Table 4.2 For the maximum speed, (h / Di = 0.813)

	C_{Rm}			fc		
fc	Su	α	Suα	Su	α	Suα
0.02092	0.00215	1.04486	0.002246	0.00215	1.04486	0.002246
0.02071	0.00215	1.04442	0.002246	0.00215	1.04442	0.002246
0.01987	0.00215	1.0427	0.002242	0.00215	1.0427	0.002242
0.01975	0.00215	1.04246	0.002241	0.00215	1.04246	0.002241
0.01934	0.00215	1.04161	0.00224	0.00215	1.04161	0.00224
0.01925	0.00215	1.04144	0.00224	0.00215	1.04144	0.00224
0.01906	0.00215	1.04104	0.002238	0.00215	1.04104	0.002238
0.0187	0.00215	1.04029	0.002236	0.00215	1.04029	0.002236
0.0184	0.00215	1.03969	0.002235	0.00215	1.03969	0.002235
0.01832	0.00215	1.0395	0.002235	0.00215	1.0395	0.002235

For the maximum expense, (h/Di=0.95). > fW-D, that: For the maximum speed, (h/Di=0.813). and that: For the pipeline occupied halfway, (h/Di=0.50).

Table 4.3 For the pipeline occupied halfway, (h/Di=0.50)

Q_d	Ks	n	g	Di	h/Di	h
0.0297	0.00025	0.000001	9.81	0.23019	0.95	0.21868
0.0297	0.00025	0.000001	9.81	0.23765	0.813	0.1925
0.0297	0.00025	0.000001	9.81	0.30714	0.5	0.15357

β	A	P	R	V	Re	C_R	n
154.1581	0.04084	0.61934	0.06594	0.727	191817	0.00526	0.01041
128.3161	0.03849	0.53223	0.07232	0.772	223213	0.00512	0.01043
90	0.03705	0.48245	0.07679	0.802	246241	0.00504	0.01045

		C_{Rm}			fc		
C	fc	Su	α	Suα	Su	α	Suα
61.07531	0.02104	0.00215	1.0451	0.002247	0.00215	1.0451	0.002247
61.88031	0.0205	0.00215	1.04398	0.002245	0.00215	1.04398	0.002245
62.40084	0.02015	0.00215	1.04329	0.002243	0.00215	1.04329	0.002243

Citation: Medina OJ. General formula for the evaluation of linear load losses. *Int J Hydro.* 2018;2(6):726–735. DOI: 10.15406/ijh.2018.02.00150

Table 5 Circular pipe (Pipe completely filled)

Q_d	Ks	n	g	Di	h/Di	h
0.0297	0.00025	0.000001	9.81	0.23626	1	0.23626
0.0327	0.00025	0.000001	9.81	0.24503	1	0.24503
0.0483	0.00025	0.000001	9.81	0.28398	1	0.28398
0.0511	0.00025	0.000001	9.81	0.2901	1	0.2901
0.0628	0.00025	0.000001	9.81	0.31367	1	0.31367
0.0655	0.00025	0.000001	9.81	0.31872	1	0.31872
0.0722	0.00025	0.000001	9.81	0.3307	1	0.3307
0.0874	0.00025	0.000001	9.81	0.35558	1	0.35558
0.1024	0.00025	0.000001	9.81	0.3776	1	0.3776
0.1075	0.00025	0.000001	9.81	0.38465	1	0.38465

β	A	P	R	V	Re	C_R	n
180	0.04384	0.74223	0.05907	0.677	160058	0.00543	0.01038
180	0.04716	0.76978	0.06126	0.693	169918	0.00537	0.01039
180	0.06334	0.89215	0.071	0.763	216556	0.00515	0.01042
180	0.0661	0.91138	0.07253	0.773	224276	0.00512	0.01043
180	0.07727	0.98542	0.07842	0.813	254916	0.00501	0.01045
180	0.07978	1.00129	0.07968	0.821	261663	0.00499	0.01046
180	0.08589	1.03892	0.08268	0.841	277980	0.00494	0.01047
180	0.0993	1.11709	0.0889	0.88	312957	0.00484	0.01049
180	0.11198	1.18627	0.0944	0.914	345285	0.00476	0.01051
180	0.1162	1.20841	0.09616	0.925	355838	0.00474	0.01052

		C_{Rm}			fc		
C	fc	Su	α	Suα	Su	α	Suα
60.11113	0.02172	0.00215	1.04648	0.00225	0.00215	1.04648	0.00225
60.43056	0.02149	0.00215	1.04602	0.002249	0.00215	1.04602	0.002249
61.71968	0.0206	0.00215	1.0442	0.002245	0.00215	1.0442	0.002245
61.90532	0.02048	0.00215	1.04395	0.002245	0.00215	1.04395	0.002245
62.58354	0.02004	0.00215	1.04305	0.002243	0.00215	1.04305	0.002243
62.72184	0.01995	0.00215	1.04286	0.002242	0.00215	1.04286	0.002242
63.04129	0.01975	0.00215	1.04245	0.002242	0.00215	1.04245	0.002242
63.66725	0.01936	0.00215	1.04166	0.002239	0.00215	1.04166	0.002239
64.18469	0.01905	0.00215	1.04102	0.002238	0.00215	1.04102	0.002238
64.34348	0.01896	0.00215	1.04082	0.002237	0.00215	1.04082	0.002237

Observe

In the examples above, the veracity of everything expressed in relation to this equation is proved, confirming that it is sufficient for the purpose stated here. That is, to be general, (law), gives all and the best solutions. The general formula of fluid resistance, (law). It is the ideal equation that responds to one of the main questions of hydraulics, as is the correct evaluation of linear load losses in the pipes. Taking advantage of the space still available, the author wants to present something interesting in relation to the calculation examples made using Excel and the trial and error method. Observe in the table that follows the similarity of the results of the hydraulic resistance coefficients, (Cr, Cch, nM and fw-d), for the different geometric shapes of the sections, (triangular, rectangular and circular, the latter working as channels and pipes). Read from left to right consecutively. Data and results of the conductions. Q, Ks, γ, S. Same for all examples.

Observe the similarity of, (V, Re, CR, CCH and nM), for the different geometric shapes of the sections, (triangular, rectangular, trapezoidal and circular). The difference between them is in the dimensions of the sections. As expected the most efficient is the circular (Table 6–10). Observe the dimensions for the geometric shapes of the sections, (triangular, rectangular, trapezoidal and circular, the latter partially and completely filled). The difference between them is in the dimensions of the sections. The examples: 1, 2, 3 and 4, are (Table 10) conduits working without pressure, ie free channels or gravity, and example 5, is working with pressure, which we know as forced pipes. To conclude this article, the author as always humbly asks that they face all the problems and proposals that do not exist, they stop seeing its true dimension in its application, sometimes not perceived by us. That is, they are reviewed with an open mind, without prejudices, because all we pursue the same goal, take our profession to a higher level, to achieve better results, which leads to full satisfaction. As a general information, we present what was exposed by B Nekrasov[2] in his book Hidráulica.

Mir Moscow 1968.

Table 6 Canal triangular

Data	Qd	Ks	n	Di	h/Di	b	h	m
	0.0297	0.00025	0.000001			0	0.1634	1.5
Results	A	P	R	Vr	Re_m	C_{Rm}	C_{CHm}	n_m
	0.04005	0.58915	0.06798	0.742	201647	0.00521	61.341	0.01041
	fw-d	Sm	a	Suα	Su	α	Suα	
	0.02086	0.00215	1.04472	0.002246	0.00215	1.04472	0.002246	
	C_{Rm}	C_{CHm}	n_m	fw-d				
	0.00521	61.341	0.01041	0.02086				

Table 7 Canal rectangular

Data	Q_d	Ks	n	g	b	h	m	
	0.0297	0.00025	0.000001	9.81	0.4	0.10097	0	
Results	A	P	R	V	Re_m	C_{Rm}	C_{CHm}	n_m
	0.04039	0.60194	0.0671	0.73537	197362	0.00523	61.227	0.01041
	fc	Su	α	Suα	Su	α	Suα	
	0.02093	0.00215	1.04488	0.002246	0.00215	1.04488	0.002246	
	C_{Rm}	C_{CHm}	n_m	fc				
	0.00523	61.227	0.01041	0.02093				

Table 8 Canal trapezoidal

Data	Q_d	Ks	n	g	b	h	m	
	0.0297	0.00025	0.000001	9.81	0.4	0.08174	1.5	
Results	A	P	R	V	Re_m	C_{Rm}	C_{CHm}	n_m
	0.04272	0.69472	0.06149	0.69525	171005	0.00537	60.464	0.01039
	fc	Su	α	Suα	Su	α	Suα	
	0.02104	0.00215	1.0451	0.002247	0.00215	1.0451	0.002247	
	CR	n	C_{CHm}	fc				
	0.00526	0.01041	61.07531	0.02104				

Table 9 Circular canal parallely filled, (h/Di=0.95)

Data	Q_d	Ks	n	g	Di	h/Di	h	
	0.0297	0.00025	0.000001	9.81	0.23019	0.95	0.21868	
Results	β	A	P	R	V	Re_m	C_R	n
	154.1581	0.04084	0.61934	0.06594	0.727	191817	0.00526	0.01041
	C_{CHm}	fc	Su	α	Suα	Su	α	Suα
	61.07531	0.02104	0.00215	1.0451	0.002247	0.00215	1.0451	0.002247
	C_R	n	C_{CHm}	fc				
	0.00526	0.01041	61.07531	0.02104				

Table 10 Circular pipe completely filled

Data	Q_d	Ks	n	g	Di	h/Di	h	
	0.0297	0.00025	0.000001	9.81	0.23626	1	0.23626	
Results	β	A	P	R	V	Re	CR	n
	180	0.04384	0.74223	0.05907	0.677	160058	0.00543	0.01038
	C	fc	Su	α	Suα	Su	α	Suα
	60.11113	0.02172	0.00215	1.04648	0.00225	0.00215	1.04648	0.00225
	CR	n	C	fc				
	0.00543	0.01038	60.11113	0.02172				

V_r	Re_m	C_{Rm}	C_{CHm}	n_m	fw-d	Sectión
0.742	201647	0.00521	61.341	0.01041	0.02086	Triangular
0.735	197362	0.00523	61.227	0.01041	0.02093	Rectangular
0.695	171005	0.00537	60.464	0.01039	0.02147	Trapezoidal
0.727	191817	0.00526	61.075	0.01041	0.02104	Circular no llena
0.677	160058	0.00543	60.111	0.01038	0.02172	Circular llena

1	b	h	m	b	A	P		Sectión
	0	0.1634	1.5		0.04005	0.58915		Triangular
2	b	h	m	A	P	R		
	0.4	0.10097	0	0.04039	0.60194	0.0671		Rectangular
3	b	h	m	A	P	R		
	0.4	0.08174	1.5	0.04272	0.69472	0.06149		Trapezoidal
4	Di	h/Di	h	b	A	P	R	
	0.23019	0.95	0.21868	154.1581	0.04084	0.61934	0.06594	Circ. does not fill
5	Di	h/Di	h	b	A	P	R	
	0.23626	1	0.23626	180	0.04384	0.74223	0.05907	Circular filled

Textual quotation, pages, (84 and 85). "Hydraulic head losses in pressurized currents take place on account of the decrease in the potential specific energy of the liquid, (Z+P/γ) along the flow. In this case, if the specific kinetic energy of the liquid, (V2/2g), varies along the flow, it is not due to the load losses, but due to the channel, because the energy depends only on the speed and this it is determined by the expense and the area of the section, (V=Q/A). Therefore, in a constant section tube the average speed and the specific kinetic energy remain unchanged, despite the presence of hydraulic resistance and load height losses. The magnitude of the loss of height of load is determined by in this case by the difference in the indications of two piezometers". "The calculation of the losses of load for several concrete cases comes to be one of the main questions of the hydraulics". "The kinematic similarity is the similarity of the streamlines and the proportionality of the similar speeds. It is evident that for the kinematic similarity of the flows the geometric resemblance of the channels is indispensable". "The equality of the coefficients, α1 and α2, for similar sections of two flows derives from their kinematic similarity". "For the flows with geometric similarity the relation, (λ/do fw-d/d), is the same, therefore, the condition of hydrodynamic similarity in this case consists of the equal value of the coefficient, (λ or fw-d), for said flows ". "The hydraulic slope, (piezometric), is invariable along a straight tube of constant diameter". End of appointment. The application of the general law of fluid resistance to various problems of hydraulics is very convenient, because it has a solid and proven foundation.[3–10]

Conclusion

a. The general formula of the fluid resistance, (law), is valid for the calculation of all possible cases of linear load losses in the pipes, the hydraulic concept being more efficient for this purpose, because with it the more accurate and accurate results.
b. The general law of fluid resistance is the origin of the coefficients of Chezy, Manning and Weisbach-Darcy, it is also the first formula of the uniform regime and the general formula for the calculation of linear load losses.

Acknowledgment

None.

Conflicts of interest

The author declares that there are no conflicts of interest.

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