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Review

Internal Combustion Engines Forces

Relly Victoria Virgil Petrescu

ARoTMM-IFToMM, Bucharest Polytechnic University, Bucharest, (CE), Romania

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Email: rvvpetrescu@gmail.com

Abstract: The paper presents an algorithm for determining the dynamic parameters of the internal combustion mechanism. Shows the force distribution (on the main engine mechanism) on internal combustion engines. Dynamically, tools can be distributed in the same way as forces. Practically, in dynamic regimes, speeds have the same synchronization with forces. The method applies separately for two distinct situations: When the engine is operating with a compressor and the engine system. For the two individual cases, two independent formulas for dynamic kinematic forces (gearbox) are obtained. Calculations are made for a single cylinder engine. Dynamic gear change resembles a variation in engine angular speed. It is more difficult to consider (theoretically) the effect on a multi-cylinder engine.

Keywords: Robots, Mechatronic Systems, Structure, Machines, Kinematics, Dynamics, Synthesis, Automation, Forces, Velocities, Powers, Engines, Efficiency, Geometry, Synthesis, Yield

Introduction

Today we are at a crossroads in terms of how the transports will be carried out in the future. Those who see a sudden change are insulting because such changes are made slowly, taking into account the continuous improvement of new technologies as well as the financial possibilities to change old production lines and sometimes a whole factory. Changes began massively with automation and robotization, which overcame the industrialization of old mechanization. The electronics, software, digitization, computer science, the net also bring about big, permanent changes, fast and sometimes so hard it's hard to keep up with them. Robots so initially blamed helped us to live better, to work less, easier, safer, healthier, with breaks and vacations, but also with beautiful weekends. They are now doing our hard, tiring, repetitive work in toxic, unfriendly, chemical, radiochemical, aquatic environments in the cosmos, thus avoiding many evils, protecting us, helping us, letting people work lighter and more beautiful, such as coordination, design, research.

In the field of transport, we have been helped for two hundred years by thermal engines, which even though still old we still wear today. How will it be in the future? A question that no one can answer right now. Much of public transport has already been electrified since 1970-1980, due to the major energy crisis of that period. But if about 70% of the railway transport (trains, trams, trolleybuses, subways) passed on electric, yet there are massive transports with ships, air and road which are still being used with thermal motorization, mostly for engines internal combustion, gasoline or diesel, most of which are four-stroke.

If we consider only personal cars that already exceed one billion and are almost all equipped with internal combustion engines and every year this park is still augmented by about one 100 millions new personal cars, we can easily see that fact any past or current electrification attempt is just a minor try. Vessels consume a very large amount of fuel and all use only thermal engines today. The same happens with aviation in general and electrification attempts are also minor, to some small, light aircraft and some helicopters and drones. The electrification attempts on buses have managed to bring some tens of thousands of electric buses into operation, as well as those with liquid gas (even more), but in total, they represent nothing in the fleet of over a billion cars in circulation.

When talking about hybrid cars we generally refer to hybrid vehicles with a hybrid transmission and not to hybrid engines. Hybrid engines on motor vehicles are rare and their percentage has remained insignificant.

There is talk of about twenty years of free energy and different schemes are being developed to get it in much better ways. Why then do the magnetic or electromagnetic motors still not appear on the means of transport? The major problem here is a techno-financial one because these engines are not yet reliable, they do not have a life long enough to cushion the costs of their production and the magnetic materials can degrade over the course of their operation. On the other hand, this is also the operational safety, which is vital for aircraft and we could not bet on such engines if it would have to repair them on their return if they would give up during the flight, because the return with them would no longer be possible.

The future will be electric, but it will take some time with its implementation.

An interesting solution, which has already succeeded in imposing itself on the car market, is that of hydrogen cars, a future solution, but even if it has occupied a larger segment in total, it is also insignificant, but it still plays an important role in further development of transport.

In order to remove hydrogen from the water directly on the vehicle, we still have to expect sometimes even if the possible solutions are known today because there is no emphasis on this important scientific research part from which energy from water can be extracted. Today's modern methods can dissociate water with low energy consumption, using platinum and gold as catalysts, a medium with ultraviolet radiation intensity control and the forced passage of pressure water through minicells using nanotechnologies. Then the hydrogen is burned with oxygen, resulting in water and more energy than the one used for dissociation, so water can become an energy storage medium. The cycle can then be used infinitely without losses and without pollution. The method is not yet desirable to be used even though it would only bring enormous benefits to shipbuilding, reducing pollution and massive use of oil, polluting, costly, unfriendly.

It is for the first time in the history of mankind when large companies begin to prepare for the construction of dynamic, high quality, high quality industrial electric cars, industrial scale. Several important Auto-Concerns have already dealt with this, but Volkswagen and Ford have already begun major changes to this. Years to come will bring massive production of fully electrified personal cars.

Even so, a fleet of over a billion vehicles equipped with internal combustion engines can not be removed overnight, so research in that field still needs to continue for a while and any innovative solution will still be a solid link in diminishing consumption of classical fuels, pollution and noxes. In this context, the present paper is also written (Rulkov *et al*., 2016; Agarwala, 2016; Babayemi, 2016; Gusti and Semin, 2016; Mohamed *et al*., 2016; Wessels and Raad, 2016; Maraveas *et al*., 2015; Khalil, 2015; Rhode-Barbarigos *et al*., 2015; Takeuchi *et al*., 2015; Li *et al*., 2015; Vernardos and Gantes, 2015; Bourahla and Blakeborough, 2015; Stavridou *et al*., 2015; Ong *et al*., 2015; Dixit and Pal, 2015; Rajput *et al*., 2016; Rea and Ottaviano, 2016; Zurfi and Zhang, 2016 a-b; Zheng and Li, 2016; Buonomano *et al*., 2016 a-b; Faizal *et al*., 2016; Cataldo, 2006; Ascione *et al*., 2016; Elmeddahi *et al*., 2016; Calise *et al*., 2016; Morse *et al*., 2016; Abouobaida, 2016; Rohit and Dixit, 2016; Kazakov *et al*., 2016; Alwetaishi, 2016; Riccio *et al*., 2016 a-b; Iqbal, 2016; Hasan and El-Naas, 2016; Al-Hasan and Al-Ghamdi, 2016; Jiang *et al*., 2016; Sepúlveda, 2016; Martins *et al*., 2016; Pisello *et al*., 2016; Jarahi, 2016; Mondal *et al*., 2016; Mansour, 2016; Al Qadi *et al*., 2016b; Campo *et al*., 2016; Samantaray *et al*., 2016; Malomar *et al*., 2016; Rich and Badar, 2016; Hirun, 2016; Bucinell, 2016; Nabilou, 2016b; Barone *et al*., 2016; Chisari and Bedon, 2016; Bedon and Louter, 2016; Santos and Bedon, 2016; Minghini *et al*., 2016; Bedon, 2016; Jafari *et al*., 2016; Chiozzi *et al*., 2016; Orlando and Benvenuti, 2016; Wang and Yagi, 2016; Obaiys *et al*., 2016; Ahmed *et al*., 2016; Jauhari *et al*., 2016; Syahrullah and Sinaga, 2016; Shanmugam, 2016; Jaber and Bicker, 2016; Wang *et al*., 2016; Moubarek and Gharsallah, 2016; Amani, 2016; Shruti, 2016; Pérez-de León *et al*., 2016; Mohseni and Tsavdaridis, 2016; Abu-Lebdeh *et al*., 2016; Serebrennikov *et al*., 2016; Budak *et al*., 2016; Augustine *et al*., 2016; Jarahi and Seifilaleh, 2016; Nabilou, 2016a; You *et al*., 2016; AL Qadi *et al*., 2016a; Rama *et al*., 2016; Sallami *et al*., 2016; Huang *et al*., 2016; Ali *et al*., 2016; Kamble and Kumar, 2016; Saikia and Karak, 2016; Zeferino *et al*., 2016; Pravettoni *et al*., 2016; Bedon and Amadio, 2016; Chen and Xu, 2016; Mavukkandy *et al*., 2016; Gruener, 2006; Yeargin *et al*., 2016; Madani and Dababneh, 2016; Alhasanat *et al*., 2016; Elliott *et al*., 2016; Suarez *et al*., 2016; Kuli *et al*., 2016; Waters *et al*., 2016; Montgomery *et al*., 2016; Lamarre *et al*., 2016; Daud *et al*., 2008; Taher *et al*., 2008; Zulkifli *et al*., 2008; Pourmahmoud, 2008; Pannirselvam *et al*., 2008; Ng *et al*., 2008; El-Tous, 2008; Akhesmeh *et al*., 2008; Nachiengtai *et al*., 2008; Moezi *et al*., 2008; Boucetta, 2008; Darabi *et al*., 2008; Semin and Bakar, 2008; Al-Abbas, 2009; Abdullah *et al*., 2009; Abu-Ein, 2009; Opafunso *et al*., 2009; Semin *et al*., 2009 a-c; Zulkifli *et al*., 2009; Marzuki *et al*., 2015; Bier and Mostafavi, 2015; Momta *et al*., 2015; Farokhi and Gordini, 2015; Khalifa *et al*., 2015; Yang and Lin, 2015; Chang *et al*., 2015; Demetriou *et al*., 2015; Rajupillai *et al*., 2015; Sylvester *et al*., 2015; Ab-Rahman *et al*., 2009; Abdullah and Halim, 2009; Zotos and Costopoulos, 2009; Feraga *et al*., 2009; Bakar *et al*., 2009; Cardu *et al*., 2009; Bolonkin, 2009 a-b; Nandhakumar *et al*., 2009; Odeh *et al*., 2009; Lubis *et al*., 2009; Fathallah and Bakar, 2009; Marghany and Hashim, 2009; Kwon *et al*., 2010; Aly and Abuelnasr, 2010; Farahani *et al*., 2010; Ahmed *et al*., 2010; Kunanoppadon, 2010; Helmy and

El-Taweel, 2010; Qutbodin, 2010; Pattanasethanon, 2010; Fen *et al*., 2011; Thongwan *et al*., 2011; Theansuwan and Triratanasirichai, 2011; Al Smadi, 2011; Tourab *et al*., 2011; Raptis *et al*., 2011; Momani *et al*., 2011; Ismail *et al*., 2011; Anizan *et al*., 2011; Tsolakis and Raptis, 2011; Abdullah *et al*., 2011; Kechiche *et al*., 2011; Ho *et al*., 2011; Rajbhandari *et al*., 2011; Aleksic and Lovric, 2011; Kaewnai and Wongwises, 2011; Idarwazeh, 2011; Ebrahim *et al*., 2012; Abdelkrim *et al*., 2012; Mohan *et al*., 2012; Abam *et al*., 2012; Hassan *et al*., 2012; Jalil and Sampe, 2013; Jaoude and El-Tawil, 2013; Ali and Shumaker, 2013; Zhao, 2013; El-Labban *et al*., 2013; Djalel *et al*., 2013; Nahas and Kozaitis, 2013; Petrescu and Petrescu, 2014 a-i; 2015 a-e; 2016 a-d; Fu *et al*., 2015; Al-Nasra *et al*., 2015; Amer *et al*., 2015; Sylvester *et al*., 2015b; Kumar *et al*., 2015; Gupta *et al*., 2015; Stavridou *et al*., 2015b; Casadei, 2015; Ge and Xu, 2015; Moretti, 2015; Wang *et al*., 2015; Antonescu and Petrescu, 1985; 1989; Antonescu *et al*., 1985a; 1985b; 1986; 1987; 1988; 1994; 1997; 2000a; 2000b; 2001; Aversa *et al*., 2017a; 2017b; 2017c; 2017d; 2017e; 2016a; 2016b; 2016c; 2016d; 2016e; 2016f; 2016g; 2016h; 2016i; 2016j; 2016k; 2016l; 2016m; 2016n; 2016o; Cao *et al*., 2013; Dong *et al*., 2013; Comanescu, 2010; Franklin, 1930; He *et al*., 2013; Lee, 2013; Lin *et al*., 2013; Liu *et al*., 2013; Padula and Perdereau, 2013; Perumaal and Jawahar, 2013; Petrescu, 2011; 2015a; 2015b; Petrescu and Petrescu, 1995a; 1995b; 1997a; 1997b; 1997c; 2000a; 2000b; 2002a; 2002b; 2003; 2005a; 2005b; 2005c; 2005d; 2005e; 2011a; 2011b; 2012a; 2012b; 2013a; 2013b; 2013c; 2013d; 2013e; 2016a; 2016b; 2016c; Petrescu *et al*., 2009; 2016; 2017a; 2017b; 2017c; 2017d; 2017e; 2017f; 2017g; 2017h; 2017i; 2017j; 2017k; 2017l; 2017m; 2017n; 2017o; 2017p; 2017q; 2017r; 2017s; 2017t; 2017u; 2017v; 2017w; 2017x; 2017y; 2017z; 2017aa; 2017ab; 2017ac; 2017ad; 2017ae; 2018a; 2018b; 2018c; 2018d; 2018e; 2018f; 2018g; 2018h; 2018i; 2018j; 2018k; 2018l; 2018m; 2018n).

Materials and Methods; Presents the Algorithm for the Otto Engine in Compressor System

It presents an algorithm for setting the dynamic parameters of the internal combustion engine. It shows the force distribution (on the main engine mechanism on internal combustion engines. Dynamically, tools can be distributed in the same way as forces. Practically, in dynamic regimes, instruments have the same synchronization with forces. The method applies separately for two distinct situations: When the engine is driven with a compressor and the engine system. For the two individual cases, two independent formulas for dynamic kinematic forces (gearbox) are obtained. Calculations are made for a single cylinder engine. It is more difficult to consider (theoretically) the effect on a multi-cylinder engine. Start with the primary engine mechanism in the compressor (when the engine is operating the lever, Fig. 1), (Petrescu and Petrescu, 2014h).

Now, one is going to watch forces distribution in this case (Fig. 1). The motor force F_m, perpendicular in B on the crank 1, is divided in two components: F_n and F_τ. The normal force, F_n, is transmitted along the rod (connecting rod) from point B to the point C. The tangential force, F_τ, is a rotating force which made the rotation of the connecting rod (element 2). The F_n (normal) force from the point C is divided as well in two components: F_u and F_R. The utile force, F_u, moves the piston and the radial force, F_R, press on the cylinder barrel in which guides the piston. Dynamic, the velocities can be distributed in the same way as forces. Practically, in the dynamic regimes, the velocities have the same timing as the forces: v_m: is the motor velocity; v_n: is the normal velocity, which is transmitted along the connecting rod; v_τ: is the tangential velocity, which produces the rotation of the element; v_R: is the radial velocity, who press on the cylinder barrel in which guides the piston (This velocity produces a radial vibration); v_u: The utile velocity, moves the piston (when the mechanism is in compressor system). One can write the following relations of calculation (1-2) (Petrescu and Petrescu, 2014 h):

$$
\begin{cases}
\begin{cases}
v_m \equiv v_B = l_1 \cdot \omega \\
v_n = v_m \cdot \sin(\varphi - \varphi_2) = v_m \cdot \sin(\psi - \varphi) \\
v_\tau = v_m \cdot \cos(\varphi - \varphi_2) = -v_m \cdot \cos(\psi - \varphi) \\
\\
v_u = v_n \cdot \sin\psi = v_m \cdot \sin(\psi - \varphi) \cdot \sin\psi \\
v_R = v_n \cdot \cos\psi = v_m \cdot \sin(\psi - \varphi) \cdot \cos\psi
\end{cases} \\
\begin{cases}
v_C^{Din.c} = v_u = l_1 \cdot \omega \cdot \sin(\psi - \varphi) \cdot \sin\psi \\
v_C^{Din.c} = v_C \cdot D^c = \dfrac{l_1 \cdot \omega \cdot \sin(\psi - \varphi)}{\sin\psi} \cdot D^c
\end{cases} \Rightarrow D^c = \sin^2\psi \\
\Rightarrow w^c \equiv \omega^{Din.c} = \omega \cdot D^c; \quad \dot{D}^c = 2 \cdot \sin\psi \cdot \cos\psi \cdot \dot{\psi} = \sin 2\psi \cdot \dot{\psi} \\
\begin{cases}
\dfrac{d}{dt}\left[v_C \cdot \sin\psi = l_1 \cdot \omega \cdot \sin(\psi - \varphi)\right] \\
\Rightarrow a_C \cdot \sin\psi + v_C \cdot \cos\psi \cdot \dot{\psi} = l_1 \cdot \omega \cdot \cos(\psi - \varphi) \cdot (\dot{\psi} - \omega) \\
\Rightarrow a_C = \dfrac{l_1 \cdot \omega \cdot \cos(\psi - \varphi) \cdot (\dot{\psi} - \omega)}{\sin\psi} \\
-\dfrac{l_1 \cdot \omega \cdot \sin(\psi - \varphi) \cdot \cos\psi \cdot \dot{\psi}}{\sin^2\psi}
\end{cases} \\
\\
a_C^{Din.c} = \dfrac{d}{dt}\left(v_C^{Din.c}\right) = \dfrac{d}{dt}\left(v_C \cdot D^c\right) = a_C \cdot D^c + v_C \cdot \dot{D}^c
\end{cases}
\tag{1}
$$

$$\begin{cases}\begin{cases}\cos\psi = \lambda \cdot \cos\varphi \\ \sin\psi = \sqrt{1-\lambda^2 \cdot \cos^2\varphi} \\ \psi = \arccos(\lambda \cdot \cos\varphi)\end{cases} \\ \begin{cases}\dot{\psi} = \dfrac{\lambda \cdot \omega \cdot \sin\varphi}{\sin\psi} \\ v_C = l_1 \cdot \omega \cdot \sin(\psi - \varphi) \cdot \dfrac{1}{\sin\psi} \\ D^c = \sin^2\psi \\ v_C^{Din.c} = v_C \cdot D^c \\ \dot{D}^c = \sin 2\psi \cdot \dot{\psi}\end{cases} \\ \begin{cases}a_C = \dfrac{l_1 \cdot \omega \cdot \cos(\psi - \phi) \cdot (\dot{\psi} - \omega) - v_c \cdot \cos\psi \cdot \dot{\psi}}{\sin\psi} \\ a_C^{Din.c} = a_C \cdot D^c + v_C \cdot \dot{D}^c\end{cases}\end{cases} \quad (2)$$

The forces of mechanism can be seen in the Fig. 2.

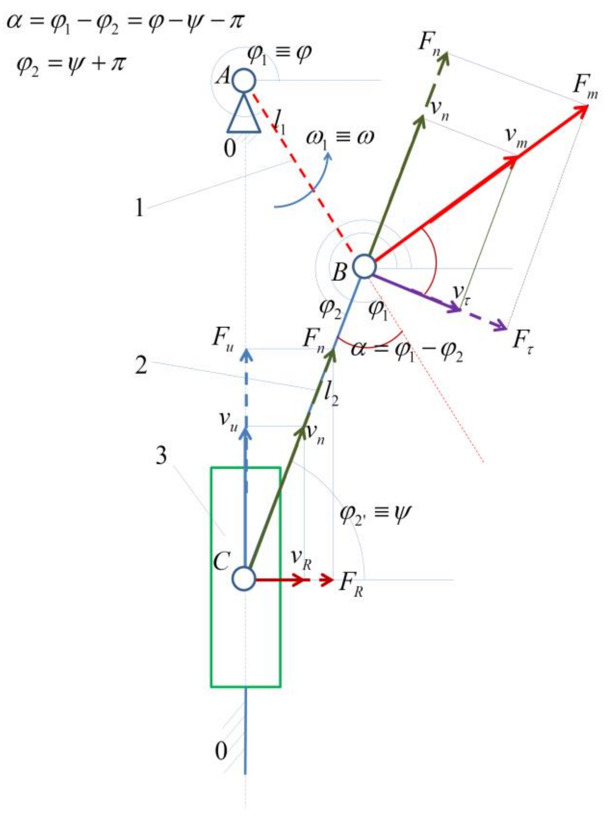

Fig. 1: The forces and velocities distribution in engine mechanism, when it is operated of the crank (element 1)

One express the motive power through conservation of powers of all the mechanism (system 3) (Petrescu and Petrescu, 2014h):

$$\begin{cases}\sum P = 0 \Rightarrow F_m \cdot l_1 \cdot \omega_1 + M_2^i \cdot \omega_2 + F_{G_2}^{ix} \cdot \dot{x}_{G_2} \\ +F_{G_2}^{iy} \cdot \dot{y}_{G_2} + F_{G_3}^{iy} \cdot \dot{y}_{G_3} + F_R \cdot \dot{y}_C = 0;\ \ F_u = -F_R \Rightarrow \\ \begin{cases}F_u = \dfrac{F_m \cdot l_1 \cdot \omega_1 + M_2^i \cdot \omega_2 + F_{G_2}^{ix} \cdot \dot{x}_{G_2} + F_{G_2}^{iy} \cdot \dot{y}_{G_2} + F_C^{iy} \cdot \dot{y}_C}{\dot{y}_C} \\ F_u = F_m \cdot \sin\psi \cdot \sin(\psi - \varphi)\end{cases} \\ \Rightarrow F_m = \dfrac{F_C^{iy} \cdot \dot{y}_C + M_2^i \cdot \omega_2 + F_{G_2}^{ix} \cdot \dot{x}_{G_2} + F_{G_2}^{iy} \cdot \dot{y}_{G_2}}{\dot{y}_C \cdot \sin\psi \cdot \sin(\psi - \varphi) - l_1 \cdot \omega_1} \\ M_m = F_m \cdot l_1\end{cases} \quad (3)$$

In the diagram below (Fig. 3) one compares this new torque with the classic (Petrescu and Petrescu, 2014 h).

The new torque was determined considering the variation of velocities with forces and forces variation due to velocities (system 3).

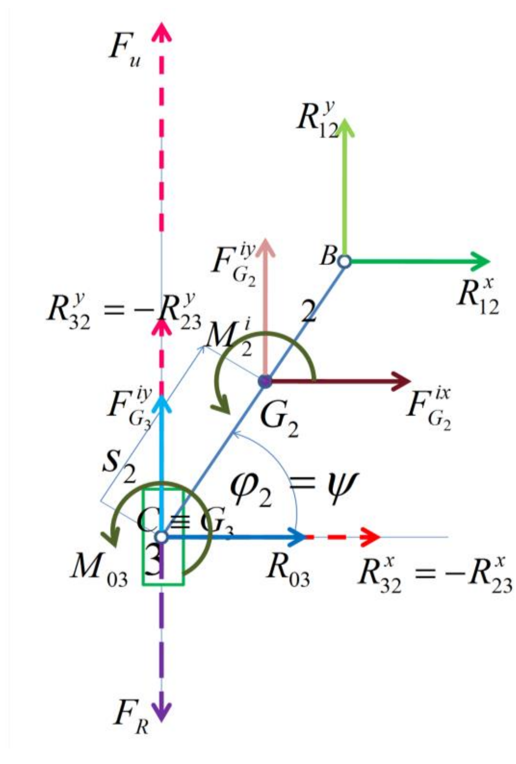

Fig. 2: The forces of mechanism, when it is operated from the crank (element 1)

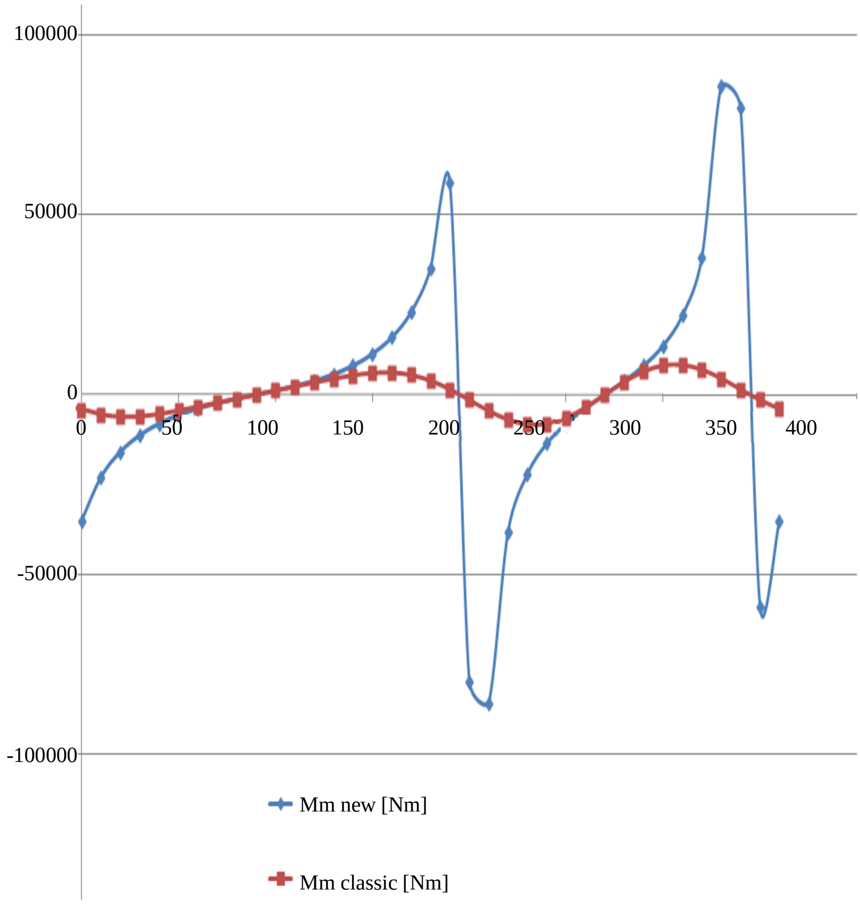

Fig. 3: The classical torque and the new torque

Presents the Algorithm for the Otto Engine in Motor System

Now we will look at the main engine mechanism in the system with the engine (when the engine mechanism is acting on the piston, Fig. 4). In this case, the use is real, being produced by the piston engine (point 3). It should be noted that the piston drive power is divided into two normal and tangential components, only a normal part being transported to the coupling B where it is divided into two other components F_u and F_c whose useful components are rotated while coding B and then (Petrescu and Petrescu, 2014h). Dynamic tools can be distributed in the same way as the synchronization forces: The v_m: is the speed of the engine; v_n: This is the normal speed, which is transmitted along the connecting rod. This is the normal speed, which is transmitted along the connecting rod; v_τ: is the speed of the tangential, which produces rod from rotating (item 2); v_c: is the speed of compression and presses the button crank (B) and then on the crank and bearing (A); this speed produces vibrations of bearings; v_u: the utile velocity, rotates crank (when the mechanism is in the system with the engine).

It can write the following relations of calculation (4-5), (Petrescu and Petrescu, 2014h):

$$\begin{cases} \begin{cases} v_n = v_m \cdot \sin\psi \\ v_u = v_n \cdot \sin(\psi-\varphi) = v_m \cdot \sin\psi \cdot \sin(\psi-\varphi) \\ v_u = \dfrac{l_1 \cdot \omega \cdot \sin(\psi-\varphi)}{\sin\psi} \cdot \sin\psi \cdot \sin(\psi-\varphi) \end{cases} \\ \begin{cases} v_u = l_1 \cdot \omega \cdot \sin^2(\psi-\varphi) \equiv v_B^{Din.m} \\ v_B^{Din.m} = v_B \cdot D^m = l_1 \cdot \omega \cdot D^m \end{cases} \Rightarrow D^m = \sin^2(\psi-\varphi) \\ \dot{D}^m = \sin 2(\psi-\varphi) \cdot (\dot{\psi}-\omega) \\ \begin{cases} a_C = \dfrac{l_1 \cdot \omega \cdot \cos(\psi-\varphi) \cdot (\dot{\psi}-\omega) - v_c \cdot \cos\psi \cdot \dot{\psi}}{\sin\psi} \\ a_C^{Din.m} = a_C \cdot D^m + v_C \cdot \dot{D}^m \end{cases} \end{cases} \tag{4}$$

$$\begin{cases} \begin{cases} \cos\psi = \lambda \cdot \cos\varphi \\ \sin\psi = \sqrt{1-\lambda^2 \cdot \cos^2\varphi} \\ \psi = \arccos(\lambda \cdot \cos\varphi) \end{cases} \\ \begin{cases} \dot{\psi} = \dfrac{\lambda \cdot \omega \cdot \sin\varphi}{\sin\psi} \\ v_C = l_1 \cdot \omega \cdot \sin(\psi - \varphi) \cdot \dfrac{1}{\sin\psi} \\ D^m = \sin^2(\psi - \varphi) \\ v_C^{Din.m} = v_C \cdot D^m \\ \dot{D}^m = \sin 2(\psi - \varphi) \cdot (\dot{\psi} - \omega) \end{cases} \\ \begin{cases} a_C = \dfrac{l_1 \cdot \omega \cdot \cos(\psi - \varphi) \cdot (\dot{\psi} - \omega) - v_c \cdot \cos\psi \cdot \dot{\psi}}{\sin\psi} \\ a_C^{Din.m} = a_C \cdot D^m + v_C \cdot \dot{D}^m \end{cases} \end{cases} \quad (5)$$

$$\alpha = \varphi_1 - \varphi_2 = \varphi - \psi - \pi$$

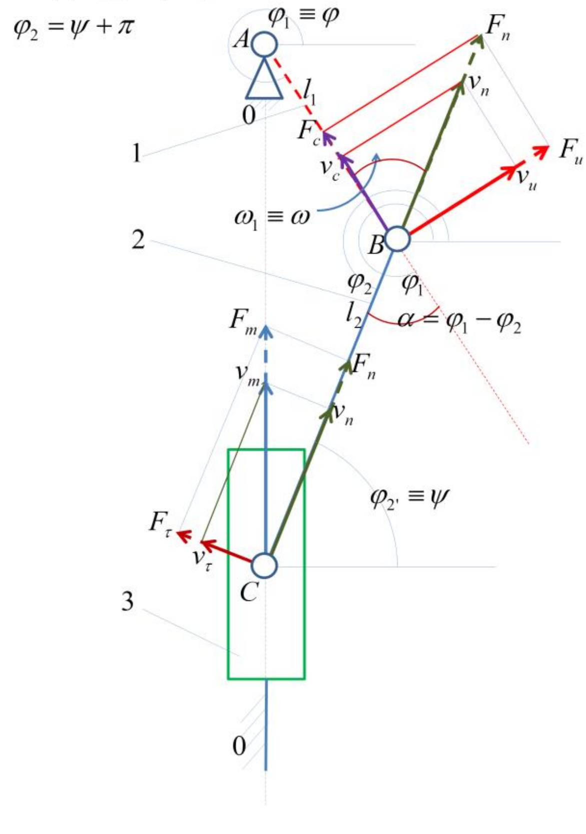

Fig. 4: The forces and velocities distribution in engine mechanism, when it is operated of the piston (element 3)

Results and Discussion

The diagrams of velocities and accelerations can be seen in the figures. In Fig. 5 it presents the velocities (cinematic and dynamic) in compressor system and in the Fig. 7 the same velocities in motor system. The acceleration (cinematic and dynamic) can be seen in the Fig. 6 (compressor system) and Fig. 8 (motor system); (λ = 0.33; n = 3000 [rpm]), (Petrescu and Petrescu, 2014h).

It presents an algorithm for setting the dynamic parameters of the internal combustion engine, which shows the force distribution (on the main engine mechanism) on internal combustion engines. Dynamically, tools can be distributed in the same way as forces. Practically, in dynamic regimes, instruments have the same synchronization with forces.

The method applies separately for two distinct situations: When the engine is driven with a compressor and the engine system. For the two individual cases, two independent formulas for dynamic kinematic forces (gearbox) are obtained. Calculations are made for a single cylinder engine. It is more difficult to consider (theoretically) the effect on the multi-cylinder engine. Start with the primary engine mechanism in the compressor (when the engine is operating the lever, see Fig. 1). One will see the main mechanism of the engine in the system with the engine (when the motor mechanism acts on the piston, Fig. 4).

In this case, the real one produced by the piston engine (point 3) is useful.

It should be noted that the piston drive power is divided into two normal and tangential components, only a normal part being transmitted through the cone at the coupling B, where it is divided into two other components, Fu and Fc, of which only the useful ones.

Dynamically, tools can be distributed in the same way as forces. Practically, in dynamic modes, the gears have the same synchronization that forces: v_m: engine speed; v_n: this is the normal speed that is transmitted along the connecting rod; v_t: is the tangential speed producing a rotation rod (point 2); v_c: is the compression speed and press the crank (B) and then rotate the bearing (A); this speed produces vibration of the bearings; v_u: Useful speed, crank rotation (when the mechanism is in the system with the engine). Internal combustion engines of the heat velocity and the actual accelerations (in dynamic schemes) are different kinematic at speeds and accelerations (classic).

Dynamically, tools can be distributed in the same way as forces. Practically, in dynamic regimes, instruments have the same synchronization with forces.

The method applies separately for two distinct situations: When the engine is driven with a compressor and the engine system.

Large variations occur in the engine system.

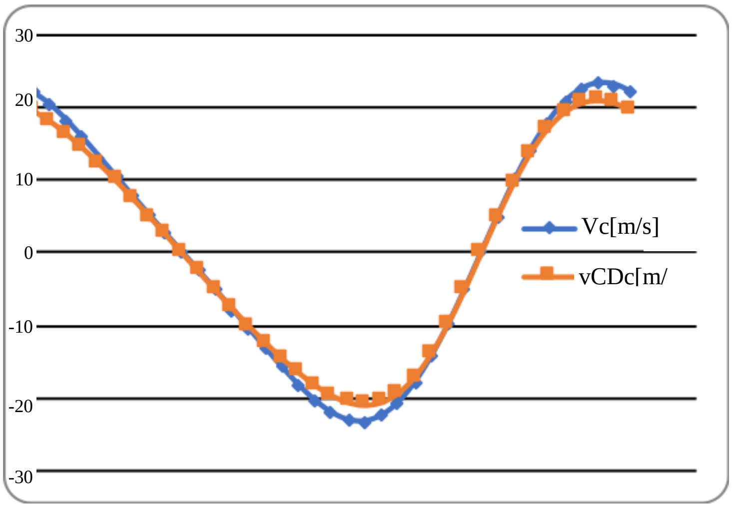

Fig. 5: The cinematic and dynamic velocities to a heat mono cylinder engine, in compressor system

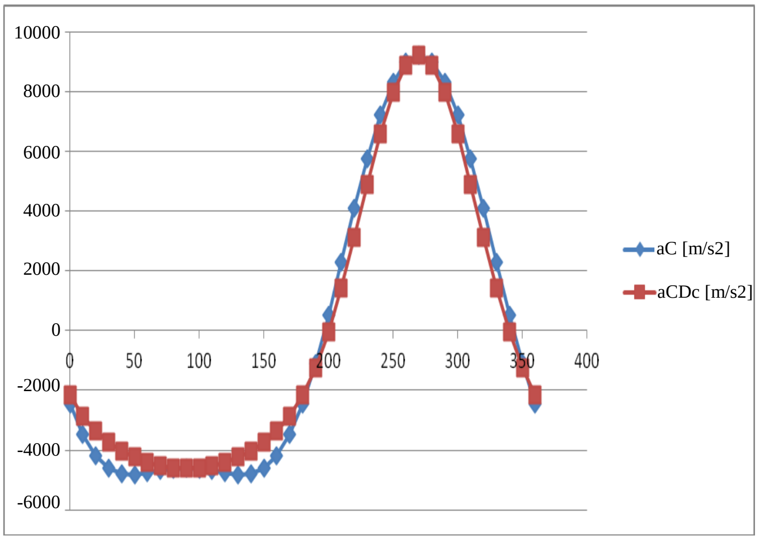

Fig. 6: The cinematic and dynamic accelerations to a heat mono cylinder engine, in compressor system

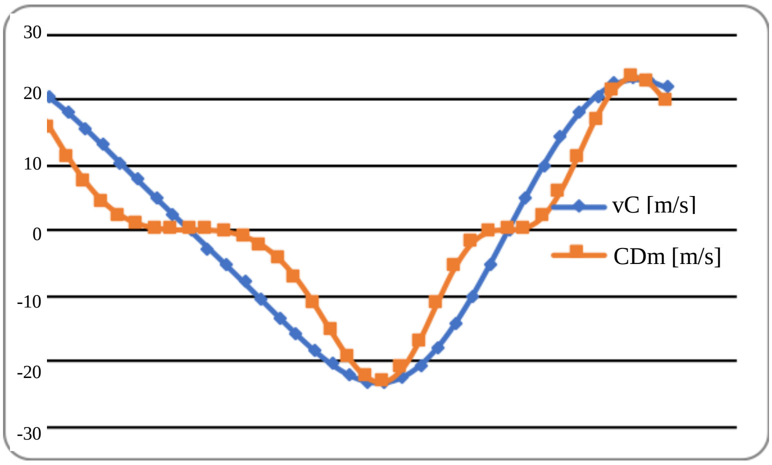

Fig. 7: The cinematic and dynamic velocities to a heat mono cylinder engine, in motor system

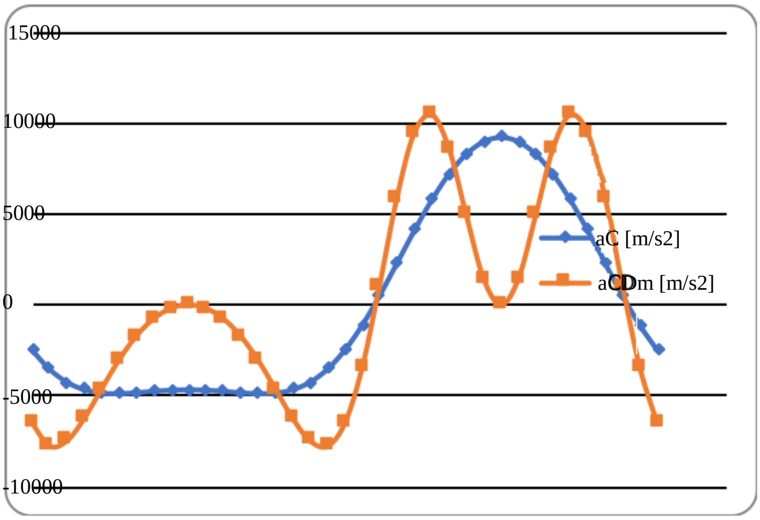

Fig. 8: The cinematic and dynamic accelerations to a heat mono cylinder engine, in motor system

Dynamic gear change resembles a variation in engine angular speed.

Calculations are made for a single cylinder engine. It is more difficult to consider the (theoretical) effect on the multi-cylinder engine (Petrescu and Petrescu, 2014h).

Conclusion

Thermal internal combustion engines of the velocity and the actual accelerations (in dynamic schemes) are different kinematic at speeds and accelerations (classic).

Dynamically, tools can be distributed in the same way as forces.

Practically, in dynamic regimes, instruments have the same synchronization with forces.

The method applies separately for two distinct situations: When the engine is driven with a compressor and the engine system.

Large variations occur in the engine system.

Dynamic gear change resembles a variation in engine angular speed.

Calculations are made for a single cylinder engine. It is more difficult to consider (theoretically) the effect on a multi-cylinder engine.

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All these matters are copyrighted! Copyrights: 394-qodGnhhtej, from 17-02-2010 13:42:18; 463-vpstuCGsiy, from 20-03-2010 12:45:30; 631-sqfsgqvutm, from 24-05-2010 16:15:22; 933-CrDztEfqow, from 07-01-2011 13:37:52.

Ethics

This article is original and contains unpublished material. Authors declare that are not ethical issues and no conflict of interest that may arise after the publication of this manuscript.

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