

# Theory of Collision of Mats

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## Abstract.

This article describes the principle of changing the direction and velocity of mats (initial particles of matter) upon their collisions, and also describes the principle of breaking of the mats.

Given article is a part of my "Real theoretical physics on basis of existence of ether".

## 1 Impact Momentum and Impact Mass

Collision of mats it is possible to consider as collision of absolutely firm particles or absolutely dense particles. As mats have an accelerated motion, then the product of the instant velocity of motion of a mat and the mass of the mat is called the *momentum* of the mat. The momentum of an mat is directed from the centre of mass of the mat in a direction of motion of the mat. The momentum of an mat in the moment before collision with other mat is called the *initial-momentum* and is denoted by  $P_{\text{pre}}$ . The momentum of an mat in the moment after the collision with other mat is called the *end-momentum* and is denoted by  $P_{\text{post}}$ .

$$P_{\text{pre}} = V_{\text{pre}} \cdot M$$

$$P_{\text{post}} = V_{\text{post}} \cdot M.$$

Here  $V_{\text{pre}}$  is the initial-velocity of the mat,  $V_{\text{post}}$  is the end-velocity and  $M$  its mass.

When colliding, two mats press to each other at a point. The point of contact of two mats during their collision is called the *impact point*. Since the mats are convex polyhedrons, the impact point can be either on the edges of both mats or on a vertex of one mat and a flat surface of the other.

If the impact point is on the line of the direction of motion of the centre of mass of one mat, then in the impact point the initial momentum of this

mat and such blow of a mat about other mat acts, is called *central impact*. And if the impact point is not on the line of the direction of motion of the centre of mass of the impact mat, then in the impact point act only a part of the initial momentum and such impact of one mat about other mat is called *noncentral impact*. If both colliding mats have a central impact, such collision is called *central collision*. And if one mat or both mats have noncentral impact such collision is called the *noncentral collision*.

At noncentral blow the initial impulse in the centre of mass of a mat is displayed on an *impact-momentum*  $P_{\text{preimp}}$  directed through the impact point, and on an *unimpact momentum*  $P_{\text{non}}$  directed perpendicularly to the impact momentum. At the central impact the initial momentum is a impact momentum.

The impact momentum of a mat acting in a direction from the centre of mass through a impact point, in the moment before collision with other mat is called *preimpact-momentum* and is designated  $P_{\text{preimp}}$ , but in the moment after collision is called *postimpact-momentum*  $P_{\text{postimp}}$ .

In Fig. 1 a decomposition of an initial momentum of one mat at noncentral collision with other mat is shown. As seen the impact momentum in the impact point divergently different. At collision of two mats in the impact point acts the impact momentum of both mats. The sum of two directed towards each other momentums acts on a line, passing through the impact point, is called the *general impact momentum* in given direction.

## 2 Section of Break of Mat

The mass of mat, which act on other mat in impact point is called the *impact mass*,  $M_{\text{imp}}$ . In the case of central impact, the initial momentum of a mat it is the impact momentum, since all mass of the mat participates in the impact momentum. When the impact is noncentral, then the impact momentum of a mat it is only a part of initial momentum of the mat, since only part of mass of the mat participates in the impact momentum.

The impact momentum is defined as follows:

$$P_{\text{imp}} = V_{\text{imp}} \cdot M_{\text{imp}}.$$

where  $V_{\text{imp}}$  is the impact velocity of the mat,  $M_{\text{imp}}$  the impact mass.

If the impact momentum of the impact mat coincides with the initial momentum, that is, the impact momentum is directed towards the impact point, then all the mass of the mat acts at the impact point. On the contrary,

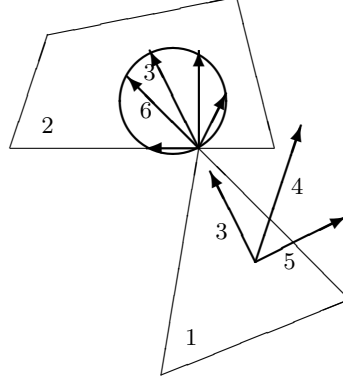


Figure 1: Collision of two mats. 1 – impact mat; 2 – impacted mat; 3 – main impact momentum; 4 – initial momentum; 5 – non-impact momentum; lateral impact momentum.

if the impact momentum of the impact mat does not coincide with the initial momentum, then only part of the mass of the impact mat acts at the impact point.

Therefore, in the case of central impact, all mass of the mat is its impact mass, otherwise it is only its part.

In the case of non-central impact, the impact mas is the sum of the direct impact mass and indirect impact mass. The direct impact mass equals to the mass of the symmetric part of the mat with respect to the line which passes through the impact momentum. The difference between the total mass of the mat and its impact-directed mass is called the *non-impact mass*. The indirect impact mass and the non-impact mass are equal and each of them is the half of the difference of the total mass and the direct impact mass:

$$M_{\text{indirect}} = M_{\text{nonimp}} = \frac{M - M_{\text{direct}}}{2}.$$

Thus the impact mass is defined as

$$\begin{aligned} M_{\text{imp}} &= M_{\text{direct}} + M_{\text{indirect}} = M_{\text{direct}} + \frac{M - M_{\text{direct}}}{2} \\ &= \frac{2M_{\text{direct}} + M - M_{\text{direct}}}{2}, \\ M_{\text{imp}} &= \frac{M_{\text{direct}} + M}{2}. \end{aligned}$$

We see that if the impact point is on the end of the projection of the impact mat (under the condition that this projection is normal to the direction of its motion), then the impact-directed mass is one-half of its total mass.

The mass of a mat has property to be in connection, without changing the form. But, at collision of mats the motion of mass of mat in the impact point changes in relation to inertial motion of other mass of the mat. Therefore there can be a rupture of the mat on two parts on impact section, where the connection of mass on this section is insufficient. The specific strength of connection of mass is identical in each point of mat and can be designated  $R_i$ .

The section of mat in all points of which the strength general impact momenta in the greatest measure exceeds specific strength of connection of mass, is called the *section of a break* of mat. The plane of a break of a mat can be direct or slightly bent. The general impact momenta acting on one mat is considered, under condition of an immovability of another mat.

### 3 Central Collisions of Spheremats

Each mat in the period between collisions is stationary independently of whether it moves or not with respect to another mat. Since the motion or rest of mats depending on the choice of a conventionally motionless point, any of the two mats could be considered conventionally motionless prior to their collision. In that case at collision of two mats the impact momentum of a moving mat extends on both mats proportionally of their mass.

At the central collision of two mats at its each mat the preimpact momentum is also the impact momentum and all mass of the mat is impact mass. If there is no break of one mat, then the momentum of each mat extends on both mats proportionally their mass.

In Fig. 2 a front normal central collision of two spheremats is schematically presented.

$$V_{\text{postimp } 1} = V_{\text{preimp } 1} - \frac{P_{\text{preimp } 2}}{M_1 + M_2}$$

$$V_{\text{postimp } 2} = V_{\text{preimp } 2} - \frac{P_{\text{preimp } 1}}{M_1 + M_2}$$

$$V_{\text{postimp } 1} = V_{\text{postimp } 2}.$$

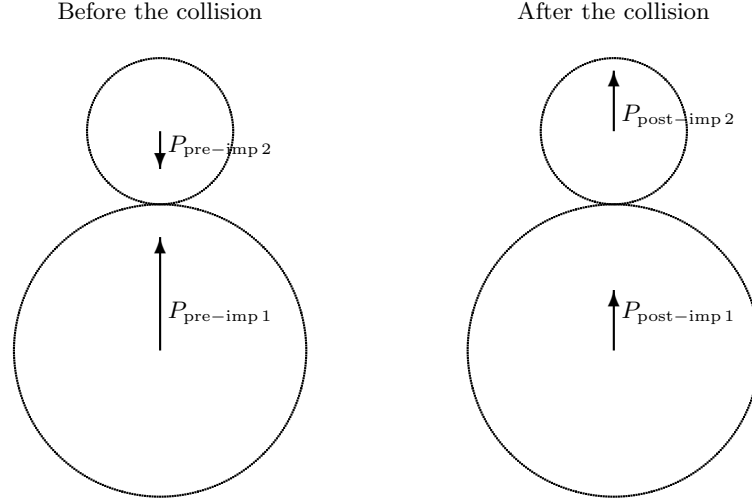


Figure 2: Frontal normal central collision of two spheremats.

Apparently, mats after the central collision do not leave each other, and remain in contact as their velocities are unidirectional and equal. But, at collision with a third mat they leave each other.

## 4 Spheremats' Noncentral Collisions

When a noncentral collision of two mats (spheremats, longmats, or ovalmats) occurs, the center of mass of each mat have not only the impact momentum, but also nonimpact momentum, directed in the direction perpendicularly to the impact momentum. Two mats after noncentral collision will leave each other.

Fig. 3 presents a scheme of a front noncentral collision of two spheremats, for  $P_{\text{preimp } 2} > P_{\text{preimp } 1}$ .

In that case:

$$\mathbf{P}_{\text{post } 1} = \mathbf{P}_{\text{postimp } 1} + \mathbf{P}_{\text{nonimp } 1}$$

$$\mathbf{P}_{\text{post } 2} = \mathbf{P}_{\text{postimp } 2} + \mathbf{P}_{\text{nonimp } 2}$$

Fig. 4 presents a consecutive noncentral collision of two spheremats, for  $P_{\text{preimp } 2} > V_{\text{preimp } 1}$ .

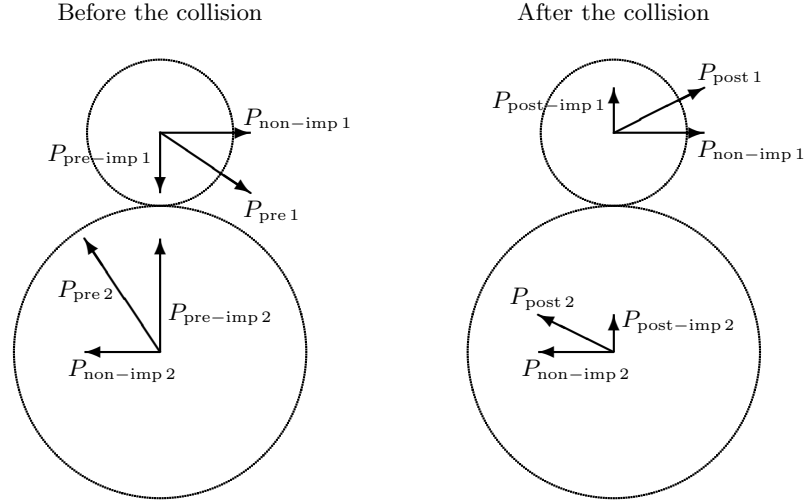


Figure 3: A noncentral front normal collision of two spheremats.

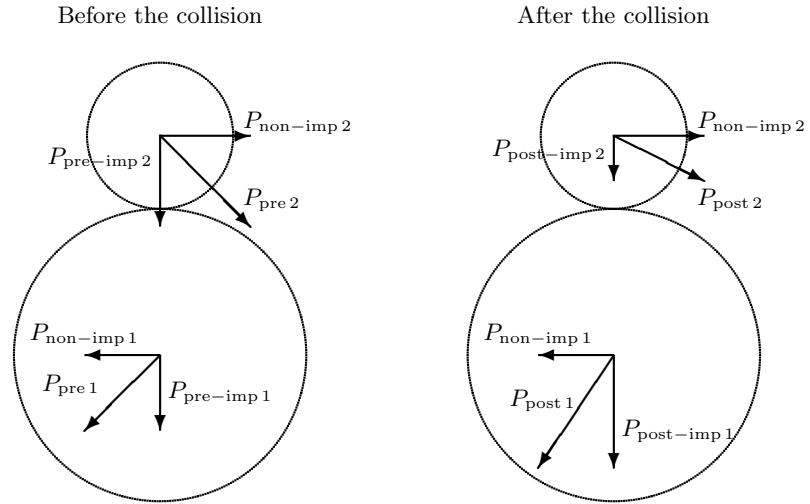


Figure 4: A noncentral consecutive collision of two spheremats.

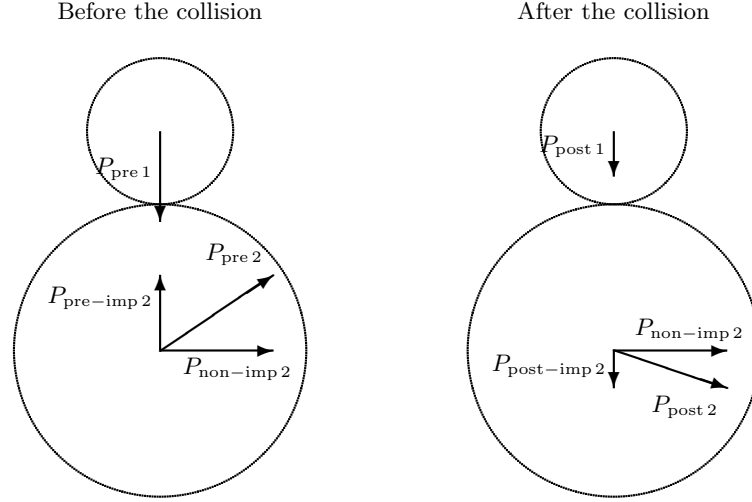


Figure 5: A collision of two spheremats.

$$\mathbf{P}_{\text{post } 1} = \mathbf{P}_{\text{postimp } 1} + \mathbf{P}_{\text{nonimp } 1}$$

$$\mathbf{P}_{\text{post } 2} = \mathbf{P}_{\text{postimp } 2} + \mathbf{P}_{\text{nonimp } 2}$$

Fig. 5 schematically shows the collision of two spheremats, one of which has a central impact, and the other noncentral impact, for  $P_{\text{imp } 1} > P_{\text{imp } 2}$ . in

Apparently, if a spheremat has made noncentral impact on another spheremat, and another spheremat has made the central impact on given spheremat given spheremat changes not only velocity, but also the direction of the motion, and further continues to move rectilinearly before new collision. Another spheremat which has made the central impact, changes only velocity of motion, but continues to move rectilinearly. Thus, at noncentral collision spheremats, they do not remain in contact, and leave from each other.

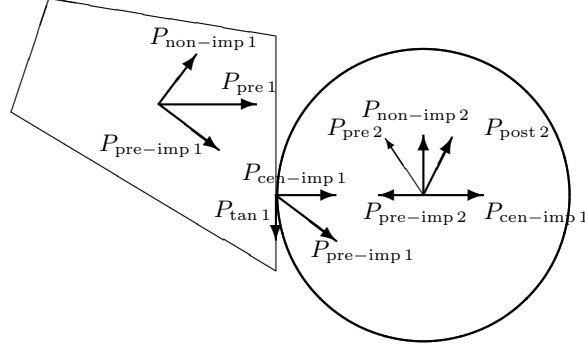


Figure 6: A noncentral frontal impact.

## 5 Noncentral Impact of a Longmat on Spheremat

Fig. 6 shows a noncentral frontal collision of a longmat with a spheremat. Only the case when the longmat hits the spheremat has been considered.

The initial momentum  $P_{\text{pre } 1}$ , which exits from the center of mass of the longmat and is directed parallel to the longmat's motion at a given time, can be considered as an impact momentum  $P_{\text{preimp } 1}$  and a non-impact momentum  $P_{\text{nonimp } 1}$ , directed normally to the impact momentum.

The impact momentum  $P_{\text{preimp } 1}$  at the impact point is decomposed into two vectors, the center-impact momentum  $P_{\text{cen-imp } 1}$  and side-impact momentum  $P_{\text{tan } 1}$ . The side-impact momentum of a longmat does not act on the co-collided spheremat, since it is directed tangentially with respect to the spheremat's surface.

As is seen, if a spheremat receives a non-central impact from a longmat, the spheremat changes its velocity and direction of motion, like in the case of colliding with a spheremat.

## 6 Noncentral Impact of a Spheremat on a Longmat. Rotation of Longmats Due to Collisions

It is easier to determine a change in the motion of a longmat (and similarly an ovalmat) upon a noncentral impact in the case when prior to a collision a longmat had only rectilinear motion without rotation. Then all the longmat's points had the same velocity in a given direction.



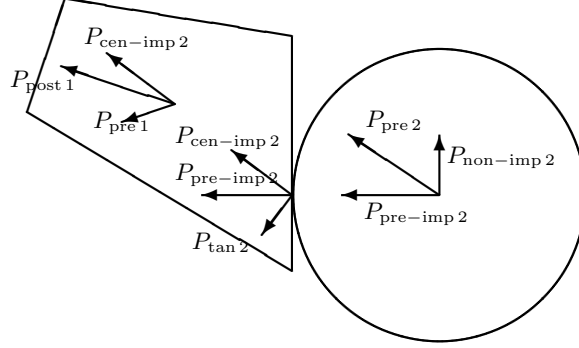


Figure 7: Non-central consecutive collision of a spheremat and an longmat.

Fig. 7 shows a non-central consecutive collision of a spheremat and a longmat. We consider only the case when the spheremat hits the longmat.

As is seen, in a noncentral impact on a longmat, the impact momentum  $P_{\text{preimp}2}$  from the impact point is not directed towards the longmat's center. But this impact momentum could be decomposed into the center-impact momentum  $P_{\text{cen-imp}2}$  and the side-impact momentum  $P_{\text{tan}2}$ . When the momenta  $P_{\text{cen-imp}2}$  and  $P_{\text{pre}1}$  are summed, they form the momentum  $P_{\text{post}1}$  is formed, which gives the longmat rectilinear motion. The momentum  $P_{\text{tan}2}$  causes the longmat to rotate round the longmat's center of mass. The ratio of the momenta  $P_{\text{cen-imp}2}$  and  $P_{\text{tan}2}$  depends on the character of the collision, that is, on the location of the longmat's center of mass with respect to the vector of the impact momentum.

Thus, in noncentral collisions with any mats, longmats acquire a new velocity and direction of rectilinear motion and a new velocity and direction of rotation. The momentum of other impact mat also changes, but the total momentum of both mats at collision does not change.

Thus at collision of mats the law of conservation of energy (momentums) is existing, because at collision there is a redistribution of momentums of mats, that is visible on an example when one of mats is conditionally motionless.

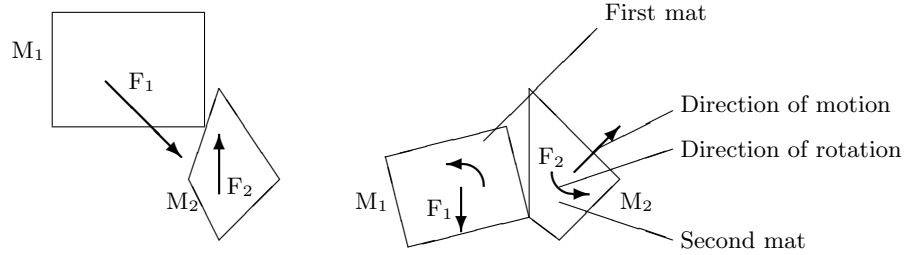


Figure 8: Mats before and after collision.

## 7 Non central collision of longmats

Two mats collide at the impact point. Due to inertia, each mat strives to move in its direction; due to that at their common impact in point, one mat presses upon another mat, thus pushing another mat into the emptiness .

Therefore, in the impact point each mat sharply, instead of consecutive, is changing the velocity and the direction of the motion while mats will not depart from each other. If in the impact point the direction of motion of the given mat appreciably is not perpendicular to the plane of collision of other mat, then in their collision, this mat moves from the impact point off through the inclined plane of other mat.

At collision of two mats the direction of motion and rotation of both mats is changing, as is shown in Fig. 8. The left side shows schematically the mats at the moment of collision, while the right side shows these mats after the collision. In the beginning of a divergence the mats due to the rotation can again will collide before leaving each other definitively.

## 8 Splitting and Breaking off of Mats

If at collision of two mats, one of mats has a section through the impact point, in which the strength of the general impact momentum in each point of section exceeds specific strength of connection of mass, then occurs a break of the mat on the this section. The spheremats break on two almost equal parts through the least impact section on diameter.

Fig. 9 shows the collision and breaking of one of the two mats. As is seen, the mats formed in breaking and chipping off, changes not only their

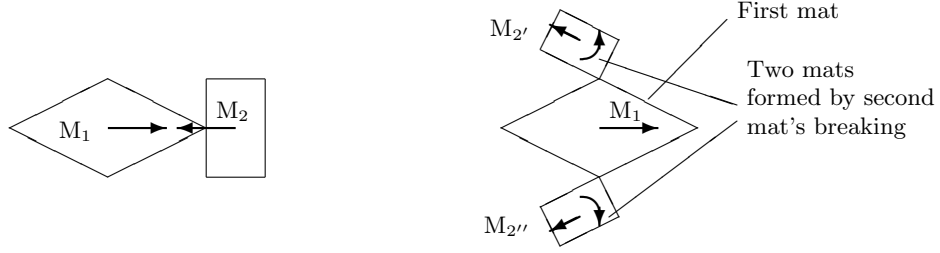


Figure 9: Collision and breaking of one of mats.

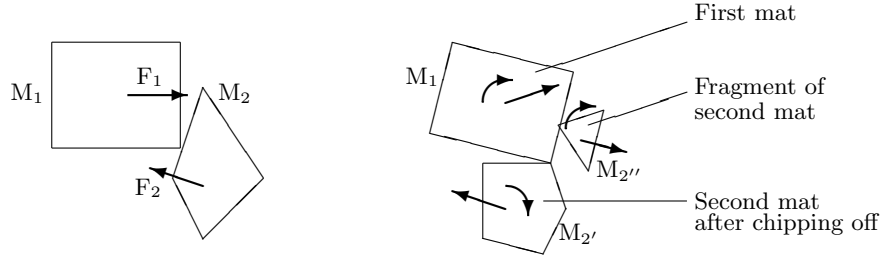


Figure 10: Collision and breaking of one of the mats.

directions of motion, but also acquire rotation.

Fig. 10 shows the collision and chipping off, of one of the mats.

Longmats have small velocity of motion and accordingly a small momentum, due to that they cannot break on the big area of section through the central part of the mat. Instead, their angular parts can be broken off. After each such breaking, the mat becomes more round, while the part broken off becomes a new longmat. At collision of ethermats with elementary particles, there can be also a break of mats.

## Conclusions

The laws of collision of mats (initial particles of matter) differ from the laws of collision of solid bodies in that the mats are absolutely integral particles,

so they are not deformed upon a collision, but may only change the direction and velocity of their motion, and one of the mats may break in two parts, that is, break up.