ANALYSIS OF RIGHT AND LEFT TURNS IN BALLROOM DANCING

Tadashi Shioya[1]
[1] Department of Aeronautics and Astronautics, University of Tokyo, Tokyo 113-8656, Japan

This presentation represents an idea of understanding the Couple Turn with Ballroom contact hold in the mechanical point of view. Natural Turn (right turn) and Reverse Turn (left turn) are compared. The description of Natural Turn and Reverse Turn in the ISTD syllabus [1], is just the same except that the terms "right" and "left" are exchanged each other. However, it is also the fact that dancers feel themselves some different movement in the left from in the right.
In the contact hold in standard ballroom dancing, the Man stands facing the Lady slightly on the right side [1], meaning that in the hold the dancer's centre is slightly left side from the contact point (left side misfit) as shown in Figure 1, and the couple dances basically in one piece. The degree of this misfit of hold depends on individual couples. This characteristic hold causes the different way of turning in the right (natural) and the left (reverse) directions.

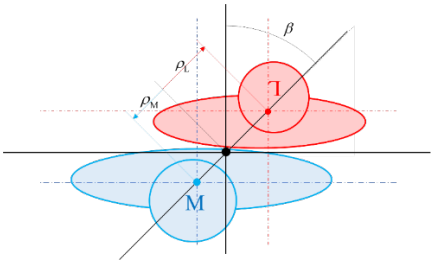


Fig. 1: Standard Ballroom Dance Hold. M: Man, L: Lady, ρ : Distance of the centre of gravity of each dancer from the centre of gravity of the couple. β (degree of misfit): Deviation angle measured from the facing direction.

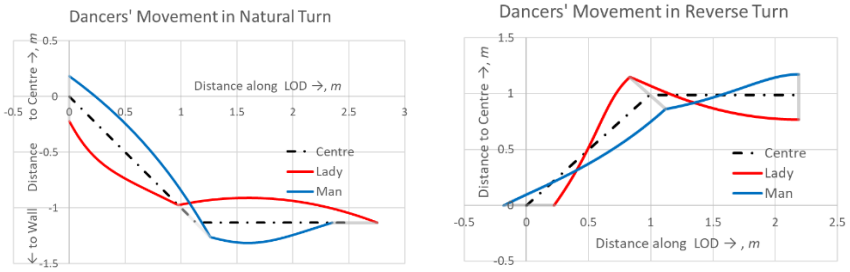
2. Analysis of Turning in Ballroom Dancing

The centre of rotation is defined as the cross point of the centre of gravity line at time t and the line at $t+\Delta t$ .The movement of the dancer near to the centre of rotation is the **inside turn,** and that far from the centre of rotation is the **outside turn**. Harmonic functions are employed in the analysis for the functions of translational movement $l_{\mathrm{G}}(t)$ of the couple [1,2], and rotational movemen $\theta(t)$, as,

Corresponding author email: tshioya@gakushikai.jp

$$l_G(t) = L\left\{\left(\frac{t}{T}\right) - \frac{1}{2\pi}\sin\left(\frac{2\pi t}{T}\right)\right\}, \qquad \theta(t) = \theta_0 + \theta_S\left\{\left(\frac{t}{T}\right) - \frac{1}{2\pi}\sin\left(\frac{2\pi t}{T}\right)\right\}, \tag{1}$$

where, T and L are one swing time and length, θ_0 is the initial angle, and θ_S is the total turning angle in the swing, i. e., $\theta_S = -(3/4)\pi$ for Natural Turn and $\theta_S = (3/4)\pi$ for Reverse Turn in Waltz. θ_0 also depends on whether Natural Turn or Reverse Turn, and also depends on the misfit of the hold β. Examples of the Dancers' movements in Natural and Reverse Turn based on the above analysis are shown in Figure 2. The related forces can also be derived from the equation.



(a) (b)

Fig. 2: Dancers' movements: (a) Natural Turn, (b) Reverse Turn.

In the natural turn, there is no inside-outside exchange, whereas there is an exchange between inside and outside in one swing of the reverse figures.

The **inertia force towards the partner** is important to maintain good balance of the couple hold. It consists of the rotational term which is the same for Lady and Man, and the translational term which is opposite sign for Lady and Man. They are also calculated from the analysis of dancers' movement. It is seen that the translational term is dominant in the inertia force in both Natural and Reverse Turns, however there also exists centrifugal effect to some extent in the middle of turn. In case of the turns with smaller radius, e. g., pivot turn, heel turn, etc, the rotational effect becomes more important.

1. ISTD (1082) The ballroom technique. 10th edition, The Imperial Society of Teachers of Dancing, London.
2. Shioya T (2018) Analysis of Swing Movement in Ballroom Dancing. ISEA 2018a , MDPI-Proceedings, 2 (6), 224.
3. Shioya T (2018) Analysis of Sway in Ballroom Dancing. ISEA 2018a , MDPI-Proceedings, 2 (6), 223.

Corresponding author email: tshioya@gakushikai.jp