3.0
複数対象物の回転動作（関節コンプライアンス制御）

```
DEF_VAR RATIO
DEF_VAR STEP, CW, PHASE, HALT_REQ
DEF_VAR O_MAX, OD_MAX;  // OMEGA_MAX, OMEGA_DOT_MAX
DEF_VAR STIFFNESS11, STIFFNESS12, STIFFNESS13
DEF_VAR STIFFNESS21, STIFFNESS22, STIFFNESS23
DEF_VAR STIFFNESS31, STIFFNESS32, STIFFNESS33
//  RATIO   : オリジナルの関節角速度に対する比率
//  STIFFNESS1  : 指1の関節剛性
//  STIFFNESS2  : 指2の関節剛性
//  STIFFNESS3  : 指3の関節剛性

    RATIO   = 1.0   // 100[%]
    STEP    = 1; CW = 1; PHASE = 1;
    HALT_REQ = 0
    // 角速度，角加速度の初期設定
        O_MAX = 20.0; OD_MAX = 20.0;
    // 関節剛性の設定
    STIFFNESS11 = 1.5
    STIFFNESS12 = 1.5
    STIFFNESS13 = 1.5
    STIFFNESS21 = 1.5
    STIFFNESS22 = 1.5
    STIFFNESS23 = 1.5
    STIFFNESS31 = 1.5
    STIFFNESS32 = 1.5
    STIFFNESS33 = 1.5
    CALL SET_STIFFNESS:
    CALL SET_SPEED_PARAMETER:

    // 関節角速度の初期値
    SET_OMEGA_MAX   ALL 30.0
    // 関節角加速度の初期値
    SET_OMEGA_DOT_MAX   ALL 20.0

    MESSAGE 初期姿勢を取ります.
    KEY_IN

//  PTP_ANGLE   F1 -60.0 -20.0 0.0
//  PTP_ANGLE   F2 -60.0 -20.0 0.0
//  PTP_ANGLE   F3 -60.0 -20.0 0.0
    PTP_ANGLE   F1 -60.0 -10.0 30.0
    PTP_ANGLE   F2 -60.0 -10.0 30.0
    PTP_ANGLE   F3 -60.0 -10.0 30.0
    WAIT_INPOS  ALL

    MESSAGE テーブルを探します.
    KEY_IN
    DETECT_FLOOR    ALL 1.0

//  MESSAGE 対象物を探します.
//  KEY_IN
//  DETECT_OBJECT   4

    MESSAGE 対象物を持ち上げます.
    KEY_IN
//  TORQUE  F1  60.0 60.0 60.0
//  TORQUE  F2  60.0 60.0 60.0
//  TORQUE  F3  60.0 60.0 60.0

    COMPLIANCE_ANGLE    F1  -26.0   66.0  95.0
    COMPLIANCE_ANGLE    F2  -26.0   66.0  95.0
    COMPLIANCE_ANGLE    F3  -26.0   66.0  95.0
    WAIT_NEAR   ALL

    MESSAGE 回転開始 (1.Fast, 2.Slow, 3.STEP/CONT. 4.CW 5.CCW 0.QUIT)
    KEY_IN
```

```
LOOP:
        MESSAGE [%PHASE%]回転開始 (1.Fast, 2.Slow, 3.STEP/CONT. 4.CW 5.CCW Q.QUIT)
    IF PHASE == 1 THEN
        IF CW == 1 THEN
            GOSUB L1CW:
            PHASE = 2
        ELSE
                        GOSUB L1CCW:
                        PHASE = 4
        ENDIF
    ELSEIF PHASE == 2 THEN
        IF CW == 1 THEN
            GOSUB L2CW:
            PHASE = 3
        ELSE
            GOSUB L2CCW:
            PHASE = 1
        ENDIF
    ELSEIF PHASE == 3 THEN
        IF CW == 1 THEN
            GOSUB L3CW:
            PHASE = 4
        ELSE
            GOSUB L3CCW:
            PHASE = 2
        ENDIF
    ELSEIF PHASE == 4 THEN
        IF CW == 1 THEN
            GOSUB L4CW:
            IF HALT_REQ == 1 THEN
                GOSUB PHASE_FINISH:
                GOTO QUIT:
            ELSE
                PHASE = 1
            ENDIF
        ELSE
            IF HALT_REQ == 1 THEN
                GOSUB PHASE_FINISH:
                GOTO QUIT:
            ELSE
                                GOSUB L4CCW:
                                PHASE = 3
            ENDIF
        ENDIF
    ENDIF
        IF STEP == 1 THEN
                GOSUB CHECK_KEY:
        ENDIF
    GOTO LOOP:

QUIT:
    MESSAGE 終了します.
    KEY_IN
    EXIT

SUBROUTINE L1CW:
    COMPLIANCE_ANGLE    F1  -12.5   90.0    27.0
    COMPLIANCE_ANGLE    F2  -27.0   34.0    100.0
    COMPLIANCE_ANGLE    F3  -27.0   34.0    100.0
L1CW_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L1CW_WAIT:
SUBEND

SUBROUTINE L1CCW:
//  チューニング前
//  COMPLIANCE_ANGLE    F1  -42.0   25.0    94.0
//  COMPLIANCE_ANGLE    F2   -6.0   96.0    38.0
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//  COMPLIANCE_ANGLE    F3   -6.0   96.0    38.0
    COMPLIANCE_ANGLE    F1   -6.0   75.0    38.0
    COMPLIANCE_ANGLE    F2  -42.0   25.0    94.0
    COMPLIANCE_ANGLE    F3  -42.0   25.0    94.0
L1CCW_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L1CCW_WAIT:
SUBEND

SUBROUTINE L2CW:
//  チューニング前
//  COMPLIANCE_ANGLE    F1   3.5     8.5    96.5
//  COMPLIANCE_ANGLE    F2  -2.0    10.0    95.5
//  COMPLIANCE_ANGLE    F3  -2.0    10.0    95.5
    COMPLIANCE_ANGLE    F1 -10.0   -10.0    90.0
    COMPLIANCE_ANGLE    F2  15.0    23.0    80.0
    COMPLIANCE_ANGLE    F3  15.0    23.0    80.0
L2CW_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L2CW_WAIT:
SUBEND

SUBROUTINE L2CCW:
//  チューニング前
//  COMPLIANCE_ANGLE    F1   3.5     8.5    96.5
//  COMPLIANCE_ANGLE    F2  -2.0    10.0    95.5
//  COMPLIANCE_ANGLE    F3  -2.0    10.0    95.5
    COMPLIANCE_ANGLE    F1  10.0    20.0    85.0
    COMPLIANCE_ANGLE    F2  -8.0    -5.0    85.0
    COMPLIANCE_ANGLE    F3  -8.0    -5.0    85.0
L2CCW_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L2CCW_WAIT:
SUBEND

SUBROUTINE L3CW:
//  チューニング前
//  COMPLIANCE_ANGLE    F1  -42.0   25.0    94.0
//  COMPLIANCE_ANGLE    F2   -6.0   96.0    38.0
//  COMPLIANCE_ANGLE    F3   -6.0   96.0    38.0
    COMPLIANCE_ANGLE    F1  -42.0   25.0    94.0
    COMPLIANCE_ANGLE    F2   -6.0   75.0    38.0
    COMPLIANCE_ANGLE    F3   -6.0   75.0    38.0
L3CW:_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L3CW:_WAIT:
SUBEND

SUBROUTINE L3CCW:
//  チューニング前
//  COMPLIANCE_ANGLE    F1  -27.0   34.0    100.0
//  COMPLIANCE_ANGLE    F2  -12.5   90.0    27.0
//  COMPLIANCE_ANGLE    F3  -12.5   90.0    27.0
    COMPLIANCE_ANGLE    F1  -27.0   34.0    100.0
    COMPLIANCE_ANGLE    F2  -8.5    90.0    27.0
    COMPLIANCE_ANGLE    F3  -8.5    90.0    27.0
L3CCW:_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L3CCW:_WAIT:
SUBEND

SUBROUTINE L4CW:
// チューニング前
//  COMPLIANCE_ANGLE    F1  -26.0   66.0  95.0
//  COMPLIANCE_ANGLE    F2  -26.0   66.0  95.0
//  COMPLIANCE_ANGLE    F3  -26.0   66.0  95.0
    COMPLIANCE_ANGLE    F1  -28.0   66.0  90.0
    COMPLIANCE_ANGLE    F2  -28.0   60.0  95.0
    COMPLIANCE_ANGLE    F3  -28.0   60.0  95.0
```

```
L4CW:_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L4CW:_WAIT:
SUBEND

SUBROUTINE L4CCW:
// チューニング前
//  COMPLIANCE_ANGLE    F1  -26.0   66.0  95.0
//  COMPLIANCE_ANGLE    F2  -26.0   66.0  95.0
//  COMPLIANCE_ANGLE    F3  -26.0   66.0  95.0
    COMPLIANCE_ANGLE    F1  -28.0   60.0  95.0
    COMPLIANCE_ANGLE    F2  -28.0   66.0  90.0
    COMPLIANCE_ANGLE    F3  -28.0   66.0  90.0
L4CCW:_WAIT:
    IF KB_HIT   GOSUB CHECK_KEY:
    IF !NEAR_ALL GOTO L4CCW:_WAIT:
SUBEND

SUBROUTINE PHASE_FINISH:
    COMPLIANCE_ANGLE    F1  -26.0   66.0  95.0
    COMPLIANCE_ANGLE    F2  -26.0   66.0  95.0
    COMPLIANCE_ANGLE    F3  -26.0   66.0  95.0
//  COMPLIANCE_ANGLE    F1  -28.5   52.5 112.0
//  COMPLIANCE_ANGLE    F2  -26.0   66.0  95.0
//  COMPLIANCE_ANGLE    F3  -26.0   66.0  95.0
    WAIT_NEAR   ALL
SUBEND

// キー入力をチェック
SUBROUTINE CHECK_KEY:
    KEY_IN
    FLUSH_BUF
    IF VAR_KEY == CHAR_1 THEN
        MESSAGE FAST
        CALL SPEED_UP:
    ELSEIF VAR_KEY == CHAR_2 THEN
        MESSAGE SLOW
        CALL SPEED_DOWN:
    ELSEIF VAR_KEY == CHAR_3 THEN
        IF STEP == 1 THEN
            MESSAGE CONTINUOUS
            STEP = -1   // CONTINUOUSLY
        ELSE
            MESSAGE STEP
            STEP = 1    // STEP
        ENDIF
    ELSEIF VAR_KEY == CHAR_4 THEN
        MESSAGE CW
        CW = 1
    ELSEIF VAR_KEY == CHAR_5 THEN
        MESSAGE CCW
        CW = -1
    ELSEIF VAR_KEY == CHAR_0 THEN
        HALT_REQ = 1
        MESSAGE 終了要求あり
    ENDIF
SUBEND

SUBROUTINE SPEED_UP:
    RATIO *= 1.5
    CALL SET_SPEED_PARAMETER:
SUBEND

SUBROUTINE SPEED_DOWN:
    RATIO /= 1.5
    CALL SET_SPEED_PARAMETER:
SUBEND

SUBROUTINE SET_STIFFNESS:
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```
    SET_ANGLE_STIFFNESS J11 STIFFNESS11
    SET_ANGLE_STIFFNESS J12 STIFFNESS12
    SET_ANGLE_STIFFNESS J13 STIFFNESS13
    SET_ANGLE_STIFFNESS J21 STIFFNESS21
    SET_ANGLE_STIFFNESS J22 STIFFNESS22
    SET_ANGLE_STIFFNESS J23 STIFFNESS23
    SET_ANGLE_STIFFNESS J31 STIFFNESS31
    SET_ANGLE_STIFFNESS J32 STIFFNESS32
    SET_ANGLE_STIFFNESS J33 STIFFNESS33
SUBEND

SUBROUTINE SET_SPEED_PARAMETER:
DEF_VAR NEW_O_MAX, NEW_OD_MAX
    NEW_O_MAX  = O_MAX * RATIO
    NEW_OD_MAX = OD_MAX * RATIO
    SET_OMEGA_MAX       ALL NEW_O_MAX
    SET_OMEGA_DOT_MAX   ALL NEW_OD_MAX
SUBEND
END
```