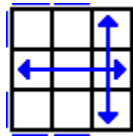
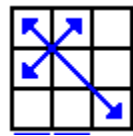


现在略微发表下对 **pll** 的理解，说实话，我认为这个最难，几乎发现不出什么新公式，不过大致理解是，某些公式其实是两个 **oll** 的组合，随常见的如下：

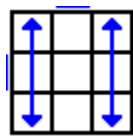
例：



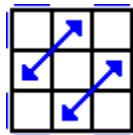
$(R U R' U')(R' F)(R^2 U' R' U')(R U R' F') = (R U R' U' R' F R F')(F R U' R' U' R U' R' F')$



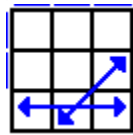
$F(R U' R' U')(R U R' F')(R U R' U')(R' F R F') = F(R U' R' U' R U' R' F')(R U R' U' R' F R F')$



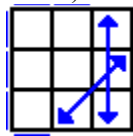
$F'(r U R' U')(r' F R^2) x' z R U' R' D' (R U R') = (F' r U R' U' r' F R)(R B L' B' R' B L B')$



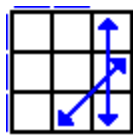
$(U) R U (R B' R' B) R' U' (f R U R' U' f') = (U) (R U R B' R' B R' U') (f R U R' U' f')$



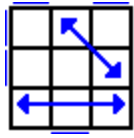
$(U) R U' L' U R' U^2 L U' L' U^2 L = (U) (R U' L' U R' U L) (L' U L U' L' U^2 L)$ 这个用镜像公式比较好



这个原理同上、、、

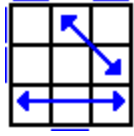


$(R U R' F')(R U R' U')(R' F R^2 U' R' U') = (R U R' F')(R U R' U')(R' F R^2 U' R' U')$



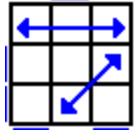
$(R U R' F' R) (U^2 R' U^2 R') F R (U R U^2 R') U' = (R U R' F' R U^2 R' U^2 R'$

$F R^2 U' R') (R U R' U R U^2 R') U'$

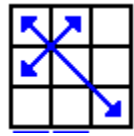


$(U^2) R U^2 R^2 (F R F' R) (U' R' F' U) (F R U' R') = (U^2) (R U^2 R^2 F R F' R$

$U^2 R') (R U R' F' U F R U' R') \text{ (双向之一)}$



$(U^2) R' U^2 R^2 x' (U' R' U R') (F R U F') (U' R' F R)$

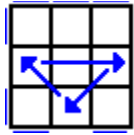


$(R^2 F R F') (U' R U' R' U) (R^2 U R' U') (R' F R F') = (R^2 F R F' U' R$

$U' R' U R) (R U R' U' R' F R F')$

最简单的莫过于三棱换，其变种公式很多（我暂时举一种例子，另一个方向可以自己类推），举个四向的。

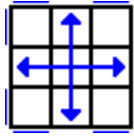
三棱换的原始公式： $M' U^2 M U^2$



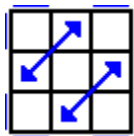
$M^2 U' M U^2 M' U' M^2$ 或 $(U') R^2 U F B' R^2 F' B U R^2$ 或 $F^2 U M' U^2 M$

$U F^2$ 或 $(U^2) M^2 U' M' U^2 M U' M^2$ 或 $(U) M^2 U M' D^2 M D^2 U' M^2$

第一种四棱换的原始公式： $R^2 U^2 R^2 U^2 R^2 U^2$

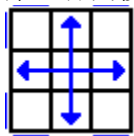


$R^2 U^2 (R U^2 R^2 U^2 R^2 U^2 R) U^2 R^2$ 玩过 `cray n6` 的人都知道这个公式吧！

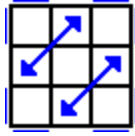


$(U R' U') (R U' R) (U R U') (R' U R U) (R^2 U') (R' U)$

第二种四棱换的原始公式： $M^2 U^2 M^2 U^2$



$M^2 U M^2 U^2 M^2 U M^2$



$M^2 U M U^2 M^2 U^2 M U M^2$ 或 $M^2 U M' U^2 M^2 U^2 M' U M^2$ 还可以

变种，自己可以试试